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Fourteenth Annual Convention of the Pacific Coast Gas Association.

The annual convention of 1906 of the Pacific Coast Gas Association was held September 18th, 19th and 20th in the assembly hall of the association, 925 Franklin street, corner of Ellis, in the building now used for the offices of the Pacific Gas & Electric Co. The attendance at the convention showed great interest on the part of the Pacific Coast gas men in their work. The papers presented, a number of which are printed in this issue of the "Journal," covered a wide field and were well received by the members. The banquet, which was given in the assembly hall on Wednesday evening, was attended by more than one hundred members and guests, and the outing on Thursday to Mt. Tamalpais proved a most enjoyable affair. The author of the paper entitled "How the San Francisco Gas & Electric Co. Supplied 40,000 Consumers After the Fire," by Mr. E. C. Jones, was voted the gold medal, presented each year for the best paper of the convention. The unavoidable absence of the President, Mr. John Martin, was a cause of must regret. Notwithstanding his absence in person, however, his spirit pervaded the entire convention, in part at least, on account of his presidential address, which was read by the Secretary and will appear in our next issue.

THE STORY OF THE RESTORATION OF THE GAS SUPPLY IN SAN FRANCISCO AFTER THE FIRE.

(By E. C. Jones.)

To see the happy faces and the evidences of hope and faith in San Francisco today one is compelled to look down toward the bay over the ruins of the once beautiful city to realize that on April 18, 1906, at 5:13 a. m., San Francisco, the city which we love so well, was visited by an earthquake and fire unprecedented in history.

The brave builders of the new city have long ago ceased to speak of the natural calamity, the earthquake, and in speaking of the sad days following April 18th, they are referred to as after the "fire." It is therefore with some hesitation and regret that the writer is compelled to describe the physical effect on gas property due to the earthquake.

Immediately before the calamity the San Francisco Gas and Electric Company was supplying the city from four sources. Carburetted water gas was manufactured and distributed from the North Beach station, supplying the north and west ends of the city.

The plant, known as the Independent, at the Potrero, was also sending out carburetted water gas in small quantity, while a new 4,000,000 foot crude oil gas set at the Potrero and the new gas works at Martin Station, which was also provided with a 4,000,000 foot oil gas set, had begun to deliver small quantities of crude oil water gas into the city.

The water gas works at North Beach was very badly damaged by the earthquake and was well out of the fire limits.

The holder station and store house at Fifth and Tehama streets was destroyed by fire, while the earthquake effects at the Potrero and Martin stations were peculiar, but so lacking in severity that these stations remained in commission, and the fires were not drawn from the oil gas generators.

Within ten minutes after the first shock of earthquake the writer was on the way to the North Beach station, with the purpose of completely shutting off the gas supply from the city as soon as possible, and at this time it is proper and a pleasure to state that every man upon whose shoulders rested responsibility was faithfully at his post, and without waiting for orders had each done the right thing to preserve and protect life and property. The gas had been shut off at the inlet and outlet of the holders at the works of the Pacific Gas Improvement Co. The gas in storage holder No. 3, with a capacity of 700,000 cubic feet, was thereby saved, this holder being but slightly damaged, but storage holders No. 1 and No. 2, with a capacity of 325,000 cubic feet each, were so badly damaged that the gas escaped.

At the North Beach station the gas was shut off at the inlet of the meter and the valves were closed at the inlet of the 2,000,000 foot storage holder.

The writer arrived on the ground at this time and found that the 24-inch outlet connections of this holder were broken off between the holder and the outlet valves, so that all attempts to seal the drip pots of the holder by syphoning water from the holder tank did not succeed in saving any of the gas in the holder, which grounded on the wooden frame work. The outlet valves of this holder were closed, however, to prevent the gas from the Potrero station from backing down through the city and escaping at this point.

The valves on the inlets and outlets of the two 500,000 cubic feet storage holders at Fifth and Tehama streets were closed immediately after the earthquake.

After the valves at the North Beach station had been closed the writer went to the Potrero gas works and closed the valves between the independent plant and the city, made a hurried test of the 12-inch steel high pressure pipe line between Martin station and the Potrero, and finding it tight, shut the valves on this line, and at 7:27 a. m. the valves at the Potrero station, which were the only remaining outlets for gas into the city mains, were closed, and a bulletin posted, noting the time and reason for shutting the gas off from the city.

Previous to this the pressure from the Potrero works into the city had been reduced to 3 inches.

At this time the fire was raging south of Market street and had not made great headway, so that the early shutting off of the gas supply prevented the addition of fuel to the flames.

The fact that the gas was shut off in the city was immediately reported to the mayor.

With a fire raging in the downtown district, which was eventually to destroy a large portion of the city, it was not

then generally known that the city water supply had been cut off by the earthquake, and the only thoughts in the minds of the employes of the San Francisco Gas and Electric Company was to quickly repair the broken mains and resume the manufacture and distribution of gas.

On this same Wednesday, the 18th of April, the street main gang commenced repairs on the 24-inch trunk line main at the junction of Van Ness avenue and Vallejo street, where the street had settled 24 inches, breaking the main, and the pipe was pulled apart 18 inches.

During Wednesday, Thursday and Friday the repairs to the mains were continued, and the two oil gas plants at Potrero and Martin stations were repaired ready for use.

During these days there were no means of procuring food unless by standing in the bread line for regular rations as they were distributed. It therefore became necessary to detail men to stand in the "bread line" and obtain enough food to keep the street main gangs fed.

The men worked with a will, apparently forgetting their personal losses and, in some instances, great sorrows.

Meanwhile the fire continued to burn the city until it reached Twentieth street on the west from Dolores to Mission, zigzagging to Fourteenth street, thence to Townsend, then around the bay to Van Ness avenue, burning practically everything east of Van Ness avenue from the bay to Market street.

Beginning at 7 o'clock Wednesday morning there were successive explosions in the feeding mains connecting the Potrero and North Beach stations.

On the 30-inch main, running from the Potrero works on Kentucky, Mariposa, Potrero avenue, Tenth, Market and Fell to Van Ness avenue, and thence along Van Ness to Broadway, there were twenty-one explosions. In nearly every case the explosion took place at a line drip or cross, where the main was weakest, and the earth around the main was thrown up, leaving openings of various sizes up to 12 feet wide and 30 feet long, and on the line of the 24-inch feeding main connecting the two stations there were as many as forty breaks due to explosions.

At other points plugs were blown out of crosses and tees, and in no instance was the lead joint disturbed, but the cast iron end of the plug was cut cleanly out of the cylinder, leaving the cylinder of the plug firmly held in the socket by the lead joint. Nearly all of these explosions occurred after the gas had been shut off of the city mains, and fortunately these explosions did no damage to life or property.

The causes of the explosions seem veiled in mystery, but the writer firmly believes that they may be accounted for as follows:

The topography of San Francisco is well known, the city having been built on a number of hills, some reaching as high as 400 feet above tide water. The large feeding mains for bringing gas into the city cross through one of the valleys at a low point from north to south. These mains, as well as those tributary to them, were broken by the shock of the earthquake. Nearly all the chimneys in the city were destroyed by the earthquake, thus making it either impossible or dangerous to build any fires in the houses. In fact, one of the first orders issued after the earthquake was that no fires should be lighted on any premises. This, of course, did not apply to gas stoves, and as gas for fuel is very popular in San Francisco, there were thousands of gas stoves remaining in the unburnt district.

It is well known that many of these stoves for days after the gas had been shut off from the city were getting their supply of gas through the acceleration of pressure due to the rise from the valleys to the hilltops, with the result that air found its way into the feeding mains in the valleys, forming an explosive mixture, which was probably ignited from some of these gas stoves, the wave of explosion passing through the explosive mixture until it found gas and air in sufficient quantities to explode and break the main. These explosions, in every instance, must have been ignited at a considerable distance, and without the knowledge of the one who caused the mischief.

The fire burned until Sunday morning, April 22d. During all this time the work on the street mains was progressing, and as it became evident that the fire would finally reach Van Ness avenue, it was decided to divide the distributing system of the city east and west at Franklin street, cutting out every portion of the burnt district, and using the 30-inch feeding main from the Potrero through Van Ness avenue as a feeding main for that portion of the city lying west of Franklin street.

Before the fire there were four systems of street mains, known as the San Francisco Gas and Electric Co., the Pacific Gas Improvement Co., the Equitable Gas Co. and the Independent Light and Power Co. These systems were tied together, and the only one provided with valves for isolating it from the others was the Independent Light & Power Co. It was decided to use this system, as far as it reached, to supply gas to the unburnt district, and all the valves between this system and the others were tightly closed.

On Sunday morning a large force of men began work at the street intersections on Franklin street, cutting mains tributary to the Franklin street main on the east side of the crosses and plugging them with iron plugs. The west ends of the main leading from the burnt district were plugged with wooden plugs. This work was continued completely around the burnt district, and it may be imagined how much thought, care and prospecting was necessary in order not to overlook a single connection, as one connecting pipe of any size would have fed gas back from the unburnt district into the burnt district, where the mains had been badly shattered, and had not been repaired, with disastrous results.

While this work was progressing the 30-inch feeding main was being repaired.

Not a foundry in San Francisco was running and it was impossible to obtain 30-inch sleeves. Few of the large machine shops were spared, but the Risdon Iron Works placed their plant at our disposal and began the turning out of 30-inch steel sleeves with steel bands shrunk on the ends. These were used to repair breaks as a substitute for cast iron sleeves.

The repairs of street mains were carried on in all parts of the unburnt district and the feeding mains by different gangs of men.

During all this time the different gangs of men were being fed at cooking camps located at the Potrero gas works, North Beach gas works, and the holder station at Fifth and Tehama streets. The number of men fed at these camps averaged over 500. The food was good and the cooking excellent.

Among the obstacles to be overcome in repairing the feeding mains and some of the larger distributing mains was the removal of water from the pipes where the mains of the Spring Valley Water Company had broken in proximity to a break in the gas main, thus filling large districts with water and sand. In some places the mains were so filled with water that it backed up to the meters, filling them also.

One of the most disagreeable drawbacks in repairing the 30-inch main was the removal of dead animals, horses, etc., that were dumped into the trenches opened by the explosions and covered with sand. These were convenient, ready-made burial places, and when the men opened up the trenches it was impossible to work until fires had been built and the animals incinerated.

Nine days after the fire the street mains in the unburnt district and the 30-inch feeding main had been repaired ready for gas, but as there was no water in the city mains it was deemed best by the city authorities not to turn gas into the mains. This was postponed until May 7th, when gas was turned into the 30-inch main at the Potrero station at 9:47 a. m., and the air was purged from this main at Van Ness and Broadway, some four miles away.

After the pressure had been turned on to the 30-inch trunk line the larger mains of the Independent system reaching through the Mission and Western Addition were successively purged of air. This work was performed by using large openings to blow through and employing a pail of soap suds and a rubber bag for taking samples of the mixture from the main at short intervals, testing it by lighting the bubbles until the air was entirely displaced by gas.

The gas used for purging was of exceptionally high candle power as an element of safety. This work was all performed without the slightest accident, which is remarkable when one considers that out of a total of 566 miles of street mains in use before the fire about 400 miles were repaired and filled with gas ready for the resumption of gas supply.

On every street in the unburnt district there were crude brick ovens constructed in front of the houses for cooking the food. Some of these consisted merely of a number of red brick laid up dry, with an improvised grate across the top, while others were more elaborate, and some people had moved their kitchen ranges into the street and surrounded them by wooden or galvanized iron huts, made of three sides and a slanting roof. Most of these street kitchens were immediately over the gas mains in the street, outside the curb line.

Before any gas had been turned into the city an order was issued to organize gangs of meter men, pipe fitters and plumbers to visit every house in the unburnt district, shut off the stop cocks at the meters and tighten the tail screws. Then a printed tag was fastened to the outlet connection of the meter, which read as follows:

"To the Consumers of Gas.—The gas supply of this house is shut off at the meter and must not be turned on until proper application is made to the gas company. Anyone interfering with said meter or stop cock is liable to prosecution by the civil authorities.

"E. E. SCHMITZ, Mayor."

"Gas Company's Address, Northwest Corner Fillmore and Haight Streets."

The name and number of the street, name of the consumer, number and statement of the meter were then entered in a book. This work was continued until May 5th, when the foreman of the meter department reported to the writer that to the best of his knowledge and belief every meter in the unburnt district (amounting to about 38,000) had been shut off and tagged. This work was completed two days before any gas was turned into the feeding mains of the city.

Immediately after the fire the work of restoring public utilities and providing for urgent needs of the city was placed in the hands of a committee of forty citizens.

One of the sub-committees appointed was the Committee on Light and Power, including both gas and electricity. One of the duties of this sub-committee was to approve of means and have general oversight of the restoration of gas supply to San Francisco.

The gas had been shut off from the street mains and services in the burnt district; gas had been turned into the feeding mains and the distributing system had been purged of air and was under pressure; every consumer's meter had been shut off from the mains, and the company was prepared to supply gas.

Here was a problem without precedent. The company was confronted with grave danger of accidents and possible responsibility. The earthquake had moved some buildings, and shaken all. House piping had been twisted and broken, chandeliers and brackets were shaken down, and others were hanging by nipples that were sheared off at the drop ells and tees.

It became the province of the Committee on Light and Power to decide how these house pipes should be tested, and a plan for regular inspection of the house pipes by means of an air pump test was seriously considered. This of necessity would have entailed a large expense upon the householders, and the work would have progressed but slowly.

The writer was made a part of this committee, and furnished with the following credentials:

"To Whom it May Concern:

"Mr. E. C. Jones, chief engineer of the San Francisco Gas and Electric Company's gas department, is authorized to act in all matters connected with the restoration of the gas supply in San Francisco, with full authority as representative of this committee.

"COMMITTEE ON LIGHT AND POWER."

And on April 25th:

"To Whom it May Concern:

"The inspection of gas piping in buildings before gas service is turned on will be under the direct charge of Mr. E. C. Jones, as representative of this committee. It is definitely understood that in such inspection work he is acting in his capacity as representative of the committee and not as chief engineer of the gas company.

"COMMITTEE ON LIGHT AND POWER."

The writer trusts that the insertion of these credentials will not be looked upon as egotism, and should it so be looked upon, the writer trusts that it is a pardonable breach, because it was a time of urgent necessity, needing the quickest possible action, and this committee felt that both the city's and company's best interests would be served by having the power vested in one man.

The writer proposed the following means of testing house pipes, which was accepted by the committee, and immediately put in effect:

San Francisco, May 9, 1906.

Mr. W. H. Leahy, Chairman Committee on Lighting and Electricity, San Francisco:

Dear Sir—Pursuant to your wishes, I herewith present an outline of a plan for rapidly and safely testing the house pipes of the gas consumers in the unburnt districts of the city. This plan seems to have met with general approval, primarily, because it will save months of time and a large outlay of money on the part of consumers of gas whose house pipes do not need repairs.

The plan is for a competent gas fitter in the employ of the gas company, and accompanied by a clerk in the meter department, to visit each place where a meter is to be reconnected. These men will make an examination of the gas fixtures and gas connections inside for the purpose of determining any apparent damage, after which they will turn the gas on at the meter. Each meter is provided with what is known as a test dial for the purpose of indicating any small leakage of gas. The men will watch the hand on this dial, and if any movement is noticed the gas will then be shut off and another inspection of the premises made to determine if the leakage is due to an open stop cock or any slight defect that may be quickly explained to the householder. In the event that the test dial on the meter shows a leakage of gas in the house pipes, the meter will be disconnected, the inlet connection pipe removed, and the service pipe to the house plugged, while a tag bearing the following inscription will be attached to the meter:

DANGER.

The house pipes in this building are defective and must be repaired before gas will be turned on.

Have a gas fitter repair the house pipes, and when repaired apply for gas at Haight and Fillmore streets.

SAN FRANCISCO GAS & ELECTRIC CO.

A paster printed in red ink, and reading as follows:

DANGER.

The house pipes in this building are defective and must be repaired by a gas fitter before gas will be turned on. After repairs have been made, procure a certificate from the gas fitter and present it at the office of the gas company at Haight and Fillmore streets.

Do not under any circumstances attempt to turn on the gas on these premises. By order

COMMITTEE ON LIGHTING AND ELECTRICITY.

will then be pasted on the outside of the house.

To obtain a supply of gas in this house it will then become necessary that the consumer shall employ a regular gas fitter to make the necessary repairs and obtain from him a certificate stating that the house pipes and fixtures have been examined and repaired and are gas tight. Upon presentation of this certificate at the office of the gas company at Haight and Fillmore streets a second inspection will be made by the gas company, and if the pipes are found to be gas tight the service with gas will be resumed.

This plan will be effective in connecting up more than 30,000 consumers in a short space of time, whereas the regular inspection of the houses by gas fitters or plumbers done in a manner according to the rules adopted by the San Francisco Gas & Electric Co. and applying to all new gas piping would require several months to test out the house piping of consumers who are anxious to get gas for cooking and lighting, and amounting to over 37,500.

The regular test of new house piping is as follows: All of the outlets for chandeliers and brackets are securely capped; an air pump is then attached to the house piping and a pressure equal to a column of mercury at least 12 inches in height is applied to the piping. This pressure is equivalent to approximately six pounds to the square inch. If the piping is found to withstand this pressure it is certified to be tight, and the gas fitter then proceeds to remove the caps and screw on the gas fixtures in the house. These fixtures are never tested excepting by gas pressure as recommended above, and no gas fixtures are made which will withstand anywhere near six pounds pressure, so that to apply this test it would first be necessary to remove all gas fixtures and cap the outlets, which would entail the labor of at least two men for two days on an average at each house, and after its completion it would then be necessary for the gas company to apply the above gas test before letting gas pressure on the house pipes.

Trusting that this plan will meet with your approval, I am sincerely yours, E. C. JONES,

Chief Engineer, Gas Department.

The first gas lighted in San Francisco after the fire was at the gas company's temporary office at O'Farrell and Franklin streets at 11 a. m., Thursday, May 10, 1906. On Friday, May 11th, the first two consumers connected were the United States Mint and Postoffice from the 10-inch main on Mission street, and at 2:10 p. m. the regular turning on of meters under the above plan was begun on Folsom near Sixteenth street.

Every available man was utilized to do the work, and as fast as the gangs of men became accustomed to the work they were divided into other gangs by the addition of intelligent but unpracticed help, so that in fourteen days practically 38,000 consumers were connected up without injury to life or property.

As soon as the first consumers were supplied with gas the work was followed by the gas stove department, and gas ranges were rapidly installed, thus enabling people who had been cooking on the streets of the city to use gas stoves for cooking in the houses. Inspection of chimneys had not yet begun, so that no gas appliances were connected to a flue.

On Saturday, May 12th, the street gas lamps in the unburnt district were lighted. This brought the city streets out of the gloom of twenty-four nights of darkness, and never was the cheeriness of a street gas lamp so much appreciated; 2,193 lamps were lighted out of a total of 5,505 in use before the fire.

The following short resume of earthquake effects may be of interest:

The earthquake movement was apparently from north to south. This was easily demonstrated by the fact that bookcases and china closets placed east and west were almost invariably tipped over, or their contents thrown out, while those placed north and south were in most cases undisturbed. Gas mains in streets running east and west were broken and drawn apart, while the street mains in streets running north and south were crushed together and telescoped, or else raised out of the ground in inverted V's. This rule applied generally, with but few exceptions.

Someone has suggested that if pipes, either water or gas, were laid on solid pile foundation in filled ground that they would be immune from earthquake damage. On Jackson street, between Drumm and Davis streets, which is made land, the street main was laid on a line of piles which went to hard pan. The piles were not purposely driven to sustain the pipe, but happened to be in the line of the main when it was laid. This pipe broke over the center of each pile, nine in number, and was not broken in the made ground where it was unsupported.

During the latter part of the first shock there was a rotating motion which had the effect of twisting gas holders out of their guide frames.

The foreman of the North Beach station was looking at the 2,000,000 feet storage holder and described it as follows:

"On going to the window I looked at the storage holder, which was vibrating like an inverted pendulum, and waves of water were coming over the wall of the tank. The relief holder was similarly affected, with water and tar coming over the tank wall. The shrubbery in the garden was whipping as though by a strong wind."

These two holders were heavily framed with latticed girders, and did not leave their guides by the rotating movement of the earthquake.

The storage holder at the Pacific Gas Improvement Company's works was twisted around two feet from the guide rails, while at Martin station the 1,500,000 feet storage holder was twisted five feet on the lower section, eight feet on the middle section and twelve feet on the upper section. At this plant the 4,000,000 feet generator was moved bodily 2½ inches to the south. All connections were of steel and no joints were broken.

A barn at the North Beach station, corner of Laguna and Bay streets, was resting upon wooden uprights about 16 inches high. These uprights were tipped over and the barn moved the length of the uprights toward the south; that is, after the earthquake it stood 16 inches on the sidewalk.

The buildings at the different plants did not suffer according to their relative strength. Some brick buildings of comparatively poor construction were unharmed. Other buildings of great strength with heavy footings on good foundations were shaken to the ground, particularly those running east and west, while buildings of the same or less strength with foundations not so good, but running in a direction north and south, were but little injured.

In one instance the walls of the building seemed so thick and strong that the rigidity of the work brought about its destruction. The movement of the walls of the building lagged behind the movement of the earthquake, and the discord of movement threw down the walls.

The amount of damage to gas property seemed to depend more upon location than upon the character of construction or foundation. Where an earthquake shock will move redwood trees bodily six or eight feet or open city streets in cracks two or three feet wide, no artificial work of whatever character can be expected to stand.

It was the intention of the writer to present to you the names of those hard working, faithful men who did the best work during the restoration of gas supply to the city, and there are many, from the general superintendent down through the ranks, who were untiring and uncomplaining in their efforts during those dark hours, but to do entire justice would require that each and every one in the company's service should be mentioned by name, as they were all best and each seemed more zealous than the other.

HOW ELECTRICITY WAS SERVED TO CONSUMERS AND STREET CAR LINES BY THE SAN FRANCISCO GAS & ELECTRIC CO. AFTER THE FIRE.

By L. E. Reynolds.

In order to get a clear idea as to how San Francisco was supplied with light and power to consumers and street car lines after the fire of April 18th, 19th and 20th, it will first be necessary to go over the normal condition of its distributing system as it existed previous to this time. It is as follows:

The downtown section was furnished by a complete Edison system of 3-wire, 220-volt, direct-current tube for lights and power. This was composed of about 130,000 feet of main on standard Edison tube and 95,000 feet of Edison tube feeders. The mains were placed on either side of the street so that services were tapped off direct to the building. These mains terminated in fused junction boxes at street intersection. The feeders extended fan-like from the station to various junction boxes, and did not directly supply any consumers. There was also a complete system of alternating current mains of 220 volt, 2ϕ-4 wire, supplied by subway transformers which in turn were connected to 2,200-volt feeders. The alternating current mains were installed by the Independent Electric Light and Power Company, and are usually parallel with the Edison system. This system contains approximately 160,000 feet of conduit, ranging from 4 to 16 ducts. There are also 1,050 manholes, which contain junction boxes, fuse boxes, and subway transformers. Within this conduit system there are installed 102,500 feet of 11,000-volt 3 conductor 3ϕ cable, and 10,000 feet of 4500 volt, 3 conductor 3ϕ cable; 75,000 feet of 2200 volt, 4 conductor 2ϕ cable; 130,000 feet of 220 volt 2ϕ–4 conductor cable; 240,000 feet of miscellaneous cable, supplying service, special installation, direct current cables in conduit system, etc. Outside the fire limits the distribution is carried on poles in the usual manner, having installed approximately 10,000 poles and 1,500 miles of wire.

The steam plant known as Station "A" is located at Twenty-third and Georgia, and contains about 30,000 horsepower of steam plant capacity. This plant is also connected by two lines to Martin power house, which is a gas engine generating station, having approximately 16,000 horsepower capacity. Two lines extend south from Martin power house and connect with water power system of California Gas & Electric Corporation. The capacity of lines between Martin power house and Station "A" is 12,000 horsepower. The larger portion of this energy was transmitted directly to central sub-station on Jessie street between Third and Fourth, having a capacity of 3,800 kilowatts in motor generator sets, 2,000 horsepower in steam engines and 1,500 kilowatts in storage batteries, 3,000 horsepower in steam generating apparatus having been destroyed February 22d by fire.

Sub-station No. 1 was at Fern avenue, between Polk and Larkin. It contained 500 kilowatts in motor generators and 250 kilowatts of storage batteries feeding directly into Edison system.

Sub-station No. 2 was on Minna, between Eleventh and Twelfth, containing 500 kilowatts in motor generators and 250 kilowatts storage batteries.

Sub-station No. 3 was on Pacific, between Dupont and Stockton, containing 500 kilowatts in motor generators and 250 kilowatts of storage batteries, also one 50-light arc transformer.

Sub-station No. 4 was an alternating current station, on Eighth street, between Mission and Howard. This station was used as a switching station between Station "A" and the other alternating current sub-station. It contained 2,000 kilowatt capacity of 11,000 volt to 2,200 volt stepdown transformers, also arc transformer for taking care of 800 city arcs, one 400 kilowatt rotary converter, 550 volts, direct current, for delivering energy to the street railway. Also one 250 kilowatt rotary converter, 220 volts, delivering energy into Edison system. This sub-station received its energy from four underground 11,000 volt, 3 conductor cables from Station "A." Also one overhead line of 3 conductor, as far as Seventh and Folsom, thence underground for three blocks, and after passing through switches goes directly to central sub-station. There is also an overhead line from Station "A" as far as Seventh and Folsom, thence underground directly to central station. From sub-station No. 4 there were two lines to each of other alternating current stations, which were located as follows:

Sub-station No. 5, Mission, between New Montgomery and Third, containing 2,000 kilowatts capacity of 11,000 volt to 2,200 volt stepdown transformers and 250 kilowatts in motor generator sets delivering direct current energy into Edison system. One 400 kilowatt 500 volt rotary converter capable of supplying energy to United Railroads. This station was supplied from two 11,000 volt cables from sub-station No. 4

Sub-station No. 6 was located on Sacramento, between Sansome and Montgomery, containing 1,500 kilowatts capacity of 11,000 volt to 2,200 volt stepdown transformers, and one 250 kilowatt rotary converter, delivering 220 volt energy into Edison system. This station was supplied by two 11,000 volt cables from sub-station No. 4.

Sub-station No. 7, on Hyde, between Golden Gate avenue and McAllister, contained 2,500 kilowatts capacity of 11,000 volt to 2,200 volt stepdown transformers, receiving its energy from two 11,000 volt cables from sub-station No. 4.

Sub-station No. 8 is at Townsend street, between Second and Third, and contains 850 kilowatts capacity in motor generator sets, delivering energy into Edison system.

There is also a Kansas street station, on Kansas, near Division, which was used as a switching station, receiving water-power energy and also steam energy, and delivering same to sub-stations 1, 2, 3 and 8, as these were all fed by overhead lines.

The earthquake and fire did not even crack the walls or do any damage at Station "A," except one transformer burn out. The machine foundations for this station were made by blasting out the solid rock, and then building up on large masses of concrete. The walls were of brick laid in cement mortar, and same is as good as before the earthquake.

Central station had its steam plant destroyed, also all the wiring and switchboards, on February 22d of this year, so that the subway with its wires, also switchboard, were only temporary, being installed as quickly as possible after the other fire. The sub-station portion of this building was fireproof, and except for the fact that a six-story brick wall fell on the roof, caving it in the running motor generator room, the station would not have suffered much damage. The high tension switching apparatus, containing large quantities of oil, did not burn. Office furniture and records of Superintendent Stations, also locker room and store room for supplies, remained intact and did not burn, although in this vicinity fire was as hot as anywhere in the burned district. This sub-station was composed of brick exterior with wire glass windows and slate roof. The motor generator sets were damaged after the roof had been broken down with large masses of brick and steel from the adjoining building, and a crane which was used for the installation of motor generators was brought down on top of them.

Sub-stations 2, 3, 4, 5, 6 and 7 were completely destroyed, so that we had no further use for them.

Sub-station No. 8 was saved by the exceptionally good work done by its operator, Mr. Fay. A steam boiler was used in the rear of sub-station No. 8 to pump oil from the bay to central station, also circulating water. A fire pump was installed in the basement of "B" station, which was just across the street from sub-station No. 8. Mr. Fay kept this fire pump going, pumping salt water on surrounding buildings until "B" station was ready to fall. He then left pump

going and worked hose, keeping his own station and several warehouses nearby from being destroyed. The station was not damaged at all.

The four underground cables from Station "A" to sub-station No. 4 were so badly wrecked by the earthquake and gas explosion that they were out of commission some ten or twelve days. The overhead lines were burned down for four blocks. The underground extension of these lines was so badly damaged that the conduit and manholes had to be reconstructed in many places. Along Seventh street, from Mission to Howard, the earth was displaced from five to eight feet in a direction lengthwise to conduit. This caused some of the manholes to crush like egg shells, although they were 12-inch concrete walls. The conduit was pulled apart at other places, and cables were wrenched and torn from their boxes, and in some cases pulled part between manholes, so that these breaks were not discovered until after we had tested with full voltage. Five different attempts were made before we succeeded in establishing connections between Station "A" and central station. The overhead line was replaced on Seventh street for four blocks. A temporary overhead line was built from Kansas street station to sub-station No. 8.

The underground Edison system had services tapped off into the basements, which had been ruined, so that every joint had to be dug up and cleared before service could be re-established on the main itself. Fortunately for the public, it was not necessary to wait to clear all of these mains, as it will probably be several months before we can open the street because of piles of debris over them. Since all of our alternating sub-stations with their apparatus have been destroyed, and also since we could not re-establish connection with our Edison mains completely for some months, it was decided to abandon the alternating current system of distribution for underground section and use the cables for direct current. We therefore had service where same was needed before the building stopped smoking, and light was established in the banks and those buildings which were not burned, as soon as it was needed. Each block of main had to be gone over, however, removing all services therefrom and tested out carefully before the main could be used.

In addition to the sub-station mentioned above, during heavy load last winter we found it necessary to build an overhead cross-town line from Station "A" over Mariposa and Seventeenth street, tapping Folsom and Mission street, running west as far as Stanyan, and thence north to Fulton, thence west to First avenue, thence north to Washington street. The function of this line was to boost up the outer end of feeders so as to keep a uniform potential at long distances from sub-stations. Pole transformers were installed on this line, transforming directly from 11,000 volts to 2,200 volts as load required. Two 750 kilowatt stepdown transformers were installed at Seventeenth street, near Folsom, which take care of all of the unburned section of the Mission for power and light. One transformer for 200 city arcs was also installed in temporary station, and a 50 kilowatt light transformer which was formerly at sub-station No. 3 was repaired and installed here. Thus all except about 100 of the street lights in the unburned section of the Mission were provided for. These had to remain out until we could get apparatus for their control.

The Western Addition was supplied by two 750 kilowatt transformers placed on the sidewalk at First avenue, near Point Lobos. Here, also, was placed a transformer for 200 city arcs. This provided for all the city arcs in the Western Addition with the exception of 100 which were purposely scattered.

On the morning of the 18th, as the fire was approaching the storeroom where all distribution supplies were maintained, we succeeded in removing one buggy full and one automobile full of linemen's tools, tape, solder and such small supplies as we could get hold of, quickly to a place of safety. As soon as the men had taken care of their families temporarily, the company established a commissary department, setting aside one wagon and two soldiers to collect food to provide for the men and their families. It was necessary in order to keep the men to care for them in this way. A mess house was established and they were boarded until better accommodations could be obtained. We thus kept a large force of men busy when we needed them most. Regular work was organized on Saturday, the third day after the earthquake, and 100 city arcs were ready to burn on Saturday night and 200 more were ready Sunday night, and so on the work progressed. On Monday many of the houses were lighted in the Western Addition. From then the work was carried on very rapidly with constantly increasing speed. We were also very busy, as soon as we could get teams, picking up our copper which had fallen down from burned lines. We regained about $60,000 worth of this metal from the streets. Every house in the unburned portion of the city which had previously been lighted by electricity had to be disconnected from the main before current could be turned on at all. Then service was established one block at a time on the company's mains after the same was inspected very carefully. Before each house was connected it was inspected by the Department of Electricity and also by one of the company's experts, and a careful test was made for broken wire and grounds. Service was then restored.

In order to get service for the street railway the energy from the water power plant and also steam plant from Station "A," which has frequency of 60 cycles, must pass through frequency changes at Martin power house, where it is changed to 13,000 volt at 25 cycles, 3ϕ. Two lines of 13,000 volts 3ϕ connect Martin power house with Geneva avenue station, which in turn connected with the Turk and Fillmore street station and steam plant at North Beach belonging to United Railroads. There are also two other 13,000 volt 25 cycle lines from the Martin power house to Bryant street station, which is also connected by two lines to meet lines between Geneva avenue and Turk and Fillmore sub-station. It was possible to run the frequency changes as soon as the United Railroads had cleared their trolley so as to be ready to receive energy. Connection was re-established in the usual manner and cars were immediately allowed to run.

It may be interesting to note that in sub-stations where lead-covered cables extend from main floor through tubing to subway, that the lead was not melted off the cable more than six inches below the floor line. This was true in sub-stations where second floor contained oil transformers, which allowed their contents to run down the walls and burn on the floor. The fire was so hot in these stations that one could peel off with their fingers from 1 to 1½ inches of the solid brick wall which had been laid in cement. In one case the wood trap door into subway burned away, but directly underneath and about two feet away was a pile of old rags containing oil and grease which did not ignite. In another station five gallons of gasoline remained in the tunnel with the trap door burned away, while building burned down and was also dynamited.

PERSONAL EXPERIENCES WITH A MUNICIPAL GAS PLANT.

By C. E. Moore

The town of Santa Clara has the only municipal gas plant on the Pacific Coast, so far as known to the writer. There is nothing remarkable about this plant except the fact that it is owned and operated by the municipality. The writer has for several years been acting as consulting engineer for the town, and as such had charge of the construction of the water and electric plants which preceded the gas plant. When gas was taken up it naturally followed that the same arrangement was carried along as regarded that plant also. Therefore, it will be understood that the engineer, as well as the council, had much of the gas business to learn; and that the writer of this does not assume to be an expert in gas matters. However, having been identified with the enterprise

since its establishment, and continuing at present to be in touch with it, and since the plant occupies rather a unique position, it has seemed that a brief account of its career may be of interest. The account will naturally fall somewhat into the line of a discussion of municipal ownership, but this will not be with the object of establishing any extreme views, but rather with the idea of drawing such inferences as are possible from our experience. Regarding the broader question of general municipal ownership, the writer has come in contact with it in many other places, and inevitably his views are somewhat colored by the sum total of all this experience, but the effort will be made here to confine deductions as strictly as possible to those following from this case. To make the situation clear, it will be necessary to first state in a brief way the causes which led up to this particular municipal ownership. Twelve years ago the town of Santa Clara took up the ownership of water supply. For this there were several powerful reasons, the chief one perhaps being the necessity for better fire protection. This plant was successful from the start. There was also a desire for a more extended system of street lighting, and it seemed advisable to take that up in connection with the water plant. This plant was installed ten years ago. It also was satisfactory, and the people came to have considerable pride in the plants. Every town, like an individual, likes to have something to talk about, and the municipal plants came to be the thing to talk about in Santa Clara. The matter now passed beyond the case of necessity, and the later movements along this line have been largely the result of the impetus of the idea. Municipal ownership became a specialty. Commercial lighting was taken up by buying out the property of the electric light company, remodeling and extending the system, and combining it with the street lighting. Current for this purpose was formerly generated by the town, but for several years past has been bought from the San Jose Light and Power Co., and it is supplied by the standard long distance transmission lines. Gas had been supplied by the San Jose Gas Co. (later the Light and Power Co.) for many years by a pipe line from their works. The condition of the town had been such that there had been little encouragement for the company to extend their lines. There had been no special effort to push the business, and the consumption was only 10,000 feet per day. However, with the coming of renewed life to the town, there began to be felt a desire for more extended service. Chiefly, the development of the gas plant may be considered as due to the idea which had taken root. There was no particular dissatisfaction with the company, and the movement was entirely devoid of enmity to it. Accordingly all the property of the company in the town was purchased at a valuation made by an expert agreed upon by both parties. The transaction was amicable and satisfactory throughout. There has since been considerable increase in the consumption (chiefly for fuel purposes) and the output is at present 35,000 feet per day. The price of gas was at first fixed at $1.75 per thousand, that being the price then charged by the gas company. Later, for service in San Jose, the company made the rate of $1.50, but no reduction was then made by the town. Still later the company reduced the rate to $1.25, and the town followed with a reduction to $1.50, and is now selling at that rate. That is to say, the town has in the matter of rates pursued a very conservative course, and has made no reduction until virtually forced to do so by the company. Of course, there is no actual competition between the two, but inasmuch as they serve adjoining territory, it is in practice difficult to maintain a much higher rate in one than in the other. It will perhaps be apparent from the foregoing that an attempt has been made to manage the plant on business principles, and not to be carried away by any popular idea that something could be had for nothing. About 20,000 feet of pipe was taken over from the company, and since that time about 50,000 feet have been laid. It has been necessary to do this work largely with unskilled labor. At the beginning the work done in remodeling the distribution system was from necessity advertised. The contractor who took the work was not accustomed to laying gas pipe. The blocks in many cases have very little fall, barely enough for surface drainage. Under these circumstances the writer put in force a system of laying to grades previously established by levels, and this system has been followed ever since. This is done so simply, with so little trouble, and with such good results from entirely unskilled labor in grading the trenches, that it would seem good policy for any company working in a flat country to follow the same system. In the old pipes, laid in the old way, with a spirit level, there have been frequent traps and stoppages. In the new mains there have not been any at all. The number of drips is also kept at a minimum, and these are located at convenient points and where they will do the most good. It may be that some gas companies use similar methods, but so far as known to the writer they generally do not. The particular methods used had previously been developed for use on sewer work. Now as to the conclusions from our experience:

First, the plant and business needs continual and watchful care. This is, of course, an entirely unnecessary thing to say to men of experience, but it is a fact that is not fully appreciated by others. In our case the care has been provided, and consequently the business has been successful. It has been very fortunate that there have been few changes of officials. The office of president of the board (or mayor) has not changed during all this time. The chairman of the water and light committee also has from the first been identified with the management. Questions of policy have been given careful consideration; just as careful as though it had been their own business. The result has been a good profit, but it is very easy to see how the balance might have been the other way. This is the chief danger that confronts any scheme of municipal ownership, namely, that men of ability may not be willing to give their attention to the business of the town or that the people will not have the good sense to keep men of that kind at the head of affairs.

Second, as to the ability to meet emergencies. We have recently had an experience of that kind growing out of the partial wrecking of all the plants by the earthquake. This rests upon the men, and not upon the system, and consequently goes back to the first question of management. In our case we feel that we have no cause for regret, inasmuch as water was supplied in about 24 hours and gas in three days.

Third, the ability to provide extensions. In this particular the municipality is decidedly at a disadvantage. Whereas a company can in this case borrow money to meet a large increase in the demands upon it, a municipality cannot do this except by a bond issue, which cannot be resorted to in all cases. Consequently it is necessary to look well ahead, and provide far in advance for such extensions of magnitude as are likely to be necessary.

Fourth, as to the attitude of customers. In these matters we are dealing not only with gas, but with human nature, and this is practically the same the world over. There is an occasional demand for lower rates, in the case of the town, as there would be with a company. There is the same distrust of meters. About half the consumers consider the collector and meter reader to be their natural enemy. The people's pride in the plant is chiefly in the abstract, and does not particularly affect their attitude toward bills and service. And yet it is not quite fair to leave the question at that, for there is a certain amount of feeling of individual ownership, which probably makes the conduct of these matters a trifle smoother than in ordinary cases.

Fifth, general conclusions. The conviction of the writer is that a municipality should hardly be advised to undertake the management of plants solely for the sake of profit, as an individual or company may do. There should in general be

other and stronger reasons. In the case of water, there often are such reasons. As we leave water supply and look along the line of other utilities, we find that in general these causes have less force. This does not mean that gas should be supplied at cost. In the first place, in a developing community, extensions and increased facilities in every way will probably be called for. If gas is supplied at cost, all this must either be provided for in the first bond issue, which on account of its uncertainty is not practicable, or must be provided by taxation later.

Secondly, the question of exact cost is a precarious one at best. It must include all unexpected and emergency expenses, and can really be determined only after a term of years. The probability is that selling at cost, as determined from ordinary running expenses, would finally result in the plant requiring support from other funds of the town.

To condense all this, we would say that a municipality, like an individual, should act with judgment and upon competent advice, and not be carried away by impulse in either direction. This is perhaps a condition which cannot be fully realized, but in this as in other affairs of life it is well to have an ideal.

EXPERIENCE WITH HIGH PRESSURE GAS MAINS.

By Sherwood Grover.

High pressure gas distribution, although not very old as applied to artificial gas, is no longer an experiment. When we say high pressure we mean over two pounds per square inch. If one picks up a Cox high pressure gas discharge computer and calculates the capacity of various size pipes, at gradually increasing pressures, it is liable to lead the imagination into the realm of the impractical; if, however, at the same time that person has a horsepower computer, similar in design, and follows these discharge computations with calculations for cost of compression, he will soon realize that there is an economical limit to the practice of transmitting gas under pressure, i. e., there is a point beyond which, under given conditions of cost for power, materials, labor, etc., it will not pay to raise the pressure, but instead it is time to increase the diameter of the pipe, or in case of a system already installed, to lay another pipe. This important branch of the subject is, however, treated in a paper at this meeting by the man best able to handle it.

High pressure systems are of two kinds, which fact has been stated in a previous article on the subject. One type in which the high pressure mains are simply feeders in the form of arteries running through a district, with regulators connected here and there to boost up pressure at weak points in the low pressure distributing mains, or they may be in the form of a loop entirely circling a town and feeding in at the dead ends. The other type is where the entire system is high pressure, varying in degree, with regulators reducing the feeding main pressure of 20 pounds or more to a distributing main pressure of 2 to 5 pounds, and this in turn reduced by regulators on each house service. The writer does not favor the second type of installation, although there are conditions under which it works very well, preferring rather low pressure on all distributing mains, not to exceed 12-inch water column, with no high pressure on service pipes. This method allows using a small and practically uniform size of pipe for distribution mains in given districts, and is specially adapted to suburban tracts, where consumers are wide apart, and main extensions do not pay high returns on investment. It is surprising how many consumers with gas bills ranging from $10 to $25 per month can be supplied by a 2-inch pipe carrying a pressure of 10-inch water column.

A high pressure system can be for convenience considered as consisting of three different parts, namely, the compression plant, the storage plant and the feeding mains.

The Compression Plant.—This includes the compressors, their motive power and piping system. Right at this point there is considerable opportunity for difference of opinion as to motive power, type and size of units employed, and arrangement of units. The first is a local question, depending upon the cost of power, together with reasonable insurance against breakdown or interruption of service. In case electricity is used, it is necessary to have either gas engine or steam engine auxiliary to insure against interrupted service, or else the storage plant must be of sufficient capacity to bridge over any delay which may occur.

Concerning type and size of units, it goes without saying that the most efficient compressors should be used, but there are several little points, such as unloading devices, automatic or otherwise, which have more or less merit, depending on the size of the installation. An automatic unloader is very handy in a small installation, but the writer questions the economy of it in a large installation. All automatic unloaders are virtually by-passes, and by-passing compressed gas means excessive temperature of the compressor, and of the gas being compressed. Unloaders of the pattern used on compressors with Corliss valves, by which the machine can be operated at one-quarter, one-half, three-quarters or full load, are very useful. They must, however, be used with judgment, and wear on the compressor be equalized by changing sides when running at part load, so that each part of the machine has the same total number hours work.

The size of units, of course, depends upon the peak load, unless you are depending on the storage plant to carry you over. Our experience in California has, however, taught us that a unit approximately equal in capacity to the peak hourly sent out is none too large, and as it is, of course, necessary to have duplicate apparatus, it is well to have the units of varying capacity, so that by running different units during the day it can be so arranged that they are running at full load, and hence at best economy most of the time.

In arrangement of units the writer believes from observation of several installations that shafting should be entirely avoided, all units being direct connected with their motive power and independent of each other. This on the score of economy in installation and also of operation.

Storage Plant.—This consists of a battery of compression tanks, arranged on a suitable foundation, together with the system of piping and regulators connecting them to the distributing mains.

A standard size and type of tank has been adopted by our company, which was determined by economy and ease of handling and railroad transportation, together with least cost per thousand cubic feet stored. This size is six feet in diameter by thirty feet in length, with dished heads. It has one manhole fitted with cover and yoke, one 2-inch reinforced tapped hole, which serves as both inlet and outlet, and one 1-inch reinforced tapped hole, to be used for drip pipe.

These tanks are placed in a row on the foundation, the number depending upon the amount of ground which can be used to best advantage. Other rows may from time to time be added on top of the first, making this installation a flexible one, which can be increased each year at a comparatively small cost, to meet the demands of a growing town. One tank, which we call the low pressure tank, differs from the rest in that it is a distributing tank and not a storage tank, and although it is equipped with a manhole and drip connection, like the storage tanks, it also has extra connections, to which are attached the regulators supplying the different feeding mains of the town.

In large installations it has been found most satisfactory to carry 20 pounds or under on the feeding mains, and hence the main compression units are built for this pressure only. As it is necessary to use 100 pounds pressure (not less than 80 pounds) on our storage tanks, in order to get capacity, it, therefore, follows we must have a compressor capable of compressing to 100 pounds. This unit, on account of the

nature of its work, can have a very small capacity in comparison to the other machines of the installation, its use being simply to keep the storage tanks full.

The general arrangement of the compression and storage plant is as follows: The discharge from the 20-pound compressors is carried by a single line of pipe to the 20-pound tank, a branch being taken for suction to the small 100-pound compressor, so that it may take gas either at 20 pounds, or at holder pressure, as the case may be. The discharge from the 100-pound compressor is carried by a single line of pipe to the storage tanks, a 2-inch connection with valve being made to each tank. This same header is continued to the 20-pound tank and is connected to it through a regulator and by-pass. This regulator is set to maintain a pressure less than 20 pounds, say, for example, 15 pounds, then as long as there is 20 pounds pressure on the distributing tank, this regulator is shut; but if for any reason the pressure drops, then this regulator comes into action and maintains the pressure at 15 pounds, as long as there is anything in excess of this in the storage tanks, or the small compressor is able to keep it up. The various feeding mains of the city are taken directly from the 20-pound tank, with a separate regulator on each, so that any pressure under 20 pounds can be carried on any main independent of the others.

In installing a complete plant of this nature, there are many practical points to which attention must be given to avoid trouble. To begin with, the compression tanks must be handled with care, to avoid subjecting them to unequal strains, which may cause the seams to leak. It is not an easy matter to make a tank, which has been injured by failure to observe this point, gas tight after it is in place.

The fittings should be selected with greatest care, and only smooth perfect castings used. Porous castings are to the high pressure pipe man what napthalene is to the complaint man. Extra heavy fittings, both flanged and screwed, should be used throughout, screwed joints avoided if possible, and only sockets with taper threads used in straight runs of pipe. The writer favors making everything above 2-inch diameter flanged. Too much care cannot be taken in making up both flange and screwed joints, and although with a perfect thread it is possible to make a tight joint with red lead, "litharge and glycerine" has often been necessary. In flange joints the simplest, cheapest and most satisfactory gasket has been found to be 3/16-inch lead wire, soldered into rings with nothing else, although red lead is sometimes used with it. For the manholes on the compression tanks ⅜-inch lead pipe makes a very satisfactory gasket.

After considerable experience with valves it has been found that nothing but extra heavy ammonia valves can be relied upon, and even these at times give trouble. There is one important fact right here, which must be remembered, and that is, an hydraulic test on a valve or stop cock is absolutely worthless if the fitting is to be used for high pressure gas; both valves and stop cocks of various types have been tested to 250 and 300 pounds water pressure and were tight, but when subjected to air pressure failed to hold over 60 pounds, and some even leaked as low as 30 pounds. Some of the above statements may look queer to an Eastern engineer, but it must be considered that California is a long way from the base of supplies, and the question with us is often "What can we get?" instead of "What is the best to use?"

Feeding Mains.—In the design of this portion of the system there is considerable opportunity to exercise ingenuity, but at the same time there are certain fundamental facts which should not be overlooked. A high pressure feeding main is subject to some of the physical laws which govern the design of a blast pipe supplying a number of sets of water gas apparatus; at the same time it is under some of the physical laws governing steam pipe design.

It naturally follows that all sharp turns should be avoided, using instead, easy curves and long sweeps. It is even well to substitute Y fittings in place of crosses or tees, where branches are taken from the main feeders. For joints the patent couplers, such as those made by S. R. Dresser Manufacturing Co. and Hammond Coupling Co., have been adopted. These, of course, are used with plain end pipe, so that at points where branches are taken from the main feeder, or regulators installed, a change piece is used which has a flange at one end and a coupling on the other. This is made up to the flanged fitting Y, cross or tee, as the case may be, and a valve placed on the branch or branches, so that the testing of the line, which is carried on regularly with the work so that no pipe is covered till tight, need not be interrupted. All work is tested to not less than 100 pounds per square inch. A feeder always ends with a valve.

In laying the line, care must be taken to properly anchor and brace all curves or bends. The gyrations of a garden hose, if left to itself with a good head of water on it, will serve to illustrate what will happen if this precaution is neglected.

The regulators are placed in manholes built in the street. They are either brick or concrete, and each regulator has an inlet and outlet and a by-pass valve. The use of two regulators in parallel is advocated, and, I believe, in use in some locations. We have found in this climate that one extra regulator of each size on hand is a good plan. As the regulators are inspected at regular intervals, trouble can be anticipated and the regulator removed to the repair shop, where proper adjustment can be made while the extra one takes its place. During the change the by-pass is operated.

The matter of drips has caused considerable trouble, but principally in systems where the entire installation is high pressure, or where the feeders are small. A device composed of fittings has been used in some cases, which makes the gas turn at a sharp angle to precipitate its moisture. This works very well on high pressure distribution mains of small installations, but it is not practical in a feeder at all. At first it was deemed sufficient to merely tap the main and blow out the condensation, with its own pressure. Experience, however. has shown that this does not always give satisfaction, and it was found necessary to go back to the low pressure gas practice and design a drip pot with an opening the full size of the pipe, which can be inserted in the line by means of the flange-coupling adapting pieces referred to above. If you stop to consider that there is a time of minimum consumption during the twenty-four hours, when the gas in the mains is almost at rest, the velocity being practically nothing, and that this occurs when the temperature is lowest, and hence best for precipitation of moisture, it is apparent that if these drip pots are placed at the low points they will catch the condensation; then it is an easy matter to blow it out with pressure.

Coating of pipe is a subject upon which numerous papers have been written, and it is still unsettled. It is not the province of this article to discuss this point. We paint our pipe, but the materials and methods at present employed are not entirely satisfactory. Too much dependence must be placed upon the skill and care of the man who does the painting and afterward upon the man who places it in the ground.

THE EQUITY OF SLIDING SCALE GAS RATES.

By F. A. Leach, Jr.

The equity of a sliding scale of rates has long been conceded in our electric business. Why not, then, in the gas industry? It is a first principle in our purchasing department to demand a low rate by dozens, a lower in gross lots and a minimum rate in carloads. Our customer naturally considers that he is entitled to a lower rate in quantity on his gas, the same as he would receive on the other fuels he might buy.

Fuels are mentioned advisedly, for a sliding scale of gas rates would affect our fuel sales very materially. Such a schedule as is herewith submitted would be attractive to large establishments now using various other kinds of fuels,

because we have not seen our way clear to make any but a regular rate. We now have among our customers whose accounts run over $300 per year, laundries, candy makers, coffee roasters, can plants, fruit canners, photo engravers, restaurants, delicatessen stores, sausage makers, hospitals, stereotypers, paper hangers, gas engine customers, etc., and practically every one of these use some other fuel for part of their operations because we have not offered sufficient inducements to obtain their entire business.

In the field of illumination, our prominent merchant who was induced to install gas arcs, and many of them, now burns only on the peak on account of expense, but if the rates were lower for additional and larger consumption, would he not be tempted to keep his place of business bright as day long after the doors were closed. He also has many dark corners which need illumination all day, which would receive attention. In this way the time limit of his load would be largely increased.

The schedule is purposely arranged to exclude the householder, for should one housewife have a higher rate than her neighbor, no matter the size of the bill, a "poor gas" complaint would lose its terror.

In Oakland, California, we have tried the sliding scale principle on the householder by making a lower rate for fuel or day consumption. This has proved eminently successful. It has practically doubled our consumption, as almost 50 per cent of the gas used is day output, and our superintendent, Mr. Beck, reports it is harder to keep the holders up from 7 to 10 a. m. than from 7 to 10 p. m.

The instructions received with the assignment of this subject were to argue it from both sides. Now, after several weeks' study, the interest of both parties seems focused on the equity of a sliding scale. Surely all purchasers are entitled to a lower rate for quantity, and there is great equity to the company in increased sales. Now that we have decided that a schedule is desirable, costs must first be studied to determine the latitude available and still maintain an adequate profit on the output. For the purpose of this argument, we will say that

Manufacturing expense is 4/10 of total cost.
Distribution expense is 3/10 of total cost.
Fixed expense is 3/10 of total cost.

For the sake of argument we will also divide the total profit into the departments of manufacturing, distribution and fixed expenses, so that the above apportionment will represent the cost and profit in each department.

Then, for an increased consumption, requiring no additional interest on bonds, no additional insurance or taxes, no additional officers, salaries nor dividends, we could allow 30 per cent discount and still be doing better than when we were only delivering the original limited amount. In addition to this we can draw from the distribution department the cost of statement taking, billing, collecting, etc., which is about 10 per cent of the total costs. As these expenses are no greater on a large bill than a small one, we may add this amount to our available discount, making it without question, 40 per cent. An ideal division of this would be:

For a monthly consumption of over 20,000 and under 30,000 cubic feet, 10 per cent.

For a monthly consumption of over 30,000 and under 40,000 cubic feet, 15 per cent.

For a monthly consumption of over 40,000 and under 50,000 cubic feet, 20 per cent.

For a monthly consumption of over 50,000 and under 75,000 cubic feet, 25 per cent.

For a monthly consumption of over 75,000 and under 100,000 cubic feet, 30 per cent.

For a monthly consumption of over 100,000 and under 150,000 cubic feet, 35 per cent.

For a monthly consumption of over 150,000 cubic feet and over, 40 per cent.

Many would hesitate before publishing such a schedule of rates; but would we hesitate to close a contract guaranteeing a minimum monthly revenue of 60 per cent of the price of 150,000 cubic feet of gas? I believe we could see our way clear to enter into such a contract. Why not, then, let our wares be known with the price marked in plain figures. It will be attractive to some prospective buyer.

THE ART OF CANVASSING.

By John Clements.

Mr. President and Fellow Members of the Pacific Coast Gas Association:

About the first of August our secretary wrote me that he would like to have me write a paper to be read at this gathering. At the same time he suggested that the title might be, "The Art of Canvassing."

The first thought that occurred to me was, can we call soliciting, drumming, canvassing (all synonymous terms) an art? On further thought I am convinced that we may so dignify it. Art, in the general acceptance of the term, is defined as the disposition, or modification, of things by human skill. Dexterity, or the power of performing certain actions, which may be mechanical, useful, liberal, or polite. Of course, I am to deal with the subject from the view-point of one interested in the gas industry, or it may be, the electrical branch of the light and power business, or both. To diverge a little, let us see if canvassing is a question which interests the average gas man or the electric light and power manager. The answer is emphatically, Yes. Even from the chief in command to the humblest employee, because it brings in new business, new life, new money, and assures a continuation of business, and employment. This I shall endeavor to show.

This is a commercial age, an age of new and useful invention, and age above all things else, of earnest, active, and even aggressive competition and rivalry.

The time was when, if the people wanted gas they had to hunt up the gas company to get it; and in doing so they were likely to find the manager right on the ground where the gas was being made. Often he was found in the act of drawing or charging the retorts, or if he had an office, it was located in the purifying room, or in one corner of the coal bunkers. Very few gas companies had anything like the offices they now maintain. It needed the electric shock of conflict to develop the world. This shock finally struck the gas business. All this may sound strange to some of the younger men that read this paper, as they have only known the two branches of business working in unison, but strange as it may seem it is none the less true.

There are still some managers that believe that if the people want what they have to sell, that they will come for it, and that they would be wasting time and money to go after the people. The time has long since passed for the gas company, its managers, or its employes, to sit down and wait for business to come to them without some effort on their part to secure it. If any one thinks different, all I have to say is that I am really sorry for him, for I know that he will find his business declining while the electric man, the gasoline man, and even Coal Oil Tommy are prospering. And why; because they rustle, they canvass. As this is applicable to the man in the light and power business, in the same manner it applies to all branches of trade.

The manufacturers of Europe have their agents in the United States. On the other hand, the American manufacturer has his agents in Europe, and not only in Europe, but all over the civilized world, and here we may ask what for? Why, to sell the products of his labor and skill, and to gain profit on his capital investments. Now, of course, the light and power companies do not have to go out of the immediate vicinity of their plants to look for new business, for the situation is much like missionary work, lots of it can be done

at home with very good and lasting effect. You, my fellow members of the Pacific Coast Gas Association, all desire to increase your business, and no doubt you are making every effort to do so. Among these efforts you are no doubt doing some canvassing, some of you in a quiet way, among friends and neighbors, some by making displays of appliances, by having now and then lectures and demonstrations. Some of you have a canvasser in the field, or it may be an organized corps of canvassers. Now, as the preacher would say, this brings us to our text, this brings me to the title of this paper: The Art of Canvassing. To define this is rather a complex matter, and can only be given by me from the standpoint of observation and experience.

The prerequisites of a canvasser must be a pleasant and agreeable disposition; he must have a surplus fund of patience, to fortify him against the rebuffs he will at times meet with. He must have the courage of a true soldier in order to combat the oft disrespectful greetings that he will encounter, and like a true soldier, he must not shoot (at the first alarm) the first man or woman that gives offense; he must remember above all things else, that he is on duty to be polite, and thus to watch and safeguard the interest of the company whose representative he is. He is not at the door or in the store or office of a prospective consumer to make an enemy, but on the contrary he is there to make a business friend. Politeness is a fine art, so it is said; it spreads sunshine in places that without it would be dark, damp, and dreary. We often read of sunny France; it is not so called because the sun shines brighter there than other parts of the world, but because the people are invariably polite. A friend of mine who spent two seasons in Paris said the politeness of the French people so impressed him that he felt if it had been necessary he could have borrowed money from any of them. I do not wish to be understood that my own ideas of politeness as they apply to a canvasser for a lighting and power company should be so far-reaching, because I am very closely connected with some of them that are not bankers. Still, I would insist on their being polite, even though some prospective consumer might fall into the error of my friend that visited Paris.

So I should say politeness is a factor. The canvasser must feel that he has something to offer that every intelligent man and woman really needs and wants. For none can dispense with the use of light and heat. What he has to offer is the most modern methods of producing these, and while he may now and then find a person that is a little doubtful, a little critical, still he knows that what he has to offer has long since passed the experimental stage, and has become an actual, simple, every day necessity. This gives him confidence, and confidence is his strongest factor.

With confidence that he is right a canvasser can push the electric button at the door bell; with confidence, he can meet the lady of the house; with confidence, he can meet the busy manager of a large manufacturing concern; with confidence, he can meet the boss Chinaman of an overall factory. In fact, with confidence, that what he has to offer is up-to-date and offered at a price that is within the reach of all, he feels himself on a sound basis. He has confidence in his business, confidence in those whom he represents, and good, modest, earnest, honest confidence in himself.

Confidence is another factor. A proper knowledge of his work is very essential. If he is selling gas stoves, ranges, water heaters, gas grates or radiators, he should be familiar with their construction, and, if possible, familiar with the consumption, or rather, I should say, the average consumption per hour. This I may say, however, is the most difficult question there is to answer, because no two persons do the same thing in exactly the same manner. Therefore, no two persons use gas alike, therefore, averages only can be given. Again, a proper knowledge of this work requires the canvasser to be somewhat, if not wholly, familiar with the use of the articles enumerated. Thus, in order that he may give intelligent and simple explanation or demonstration, his knowledge should also extend to a fair understanding of the appliances with which he is to come into competition, this in order that he may show the defects of the one and the good points of the other.

I can see no need of explaining to any one here the advantages to be gained by the intelligent use of gas or electrical appliances; you are all familiar with them. If the canvasser is working in the power line, and the question is the choice of a gas engine, he should be familiar with the use of gas as applied to motive power. The amount of gas required per horsepower, hour, the comparative cost of installation of a gas engine versus steam installation. He should be able to take these things in proper order so that he can answer questions (that will be shot at him) with exactness and decision. If he is talking with a prospective user of electric power he must be able to show him its special points and its ideal character. It will be well for him to have some data as regards existing concerns that are using such power. If possible, to cite the inquirer to some one that is using it in the same (or in a similar) line, with what he has in view. The same rules as to cost of installation, cost of maintenance and expense of running will apply here as with what I have said about the gas engine, "knowledge is a factor."

Knowledge is power and power moves the world. Now I do not mean by this the canvasser should have technical knowledge, although it would not be amiss. But what he really should know is the every day practical knowledge as it relates to the business he has in hand. Usually the prospective consumer is a practical man, a mechanic, a good business manager, that knows what he wants from a practical standpoint, so that if you talk to him in high sounding words and in technical terms, he is more apt to be confused than instructed or enlightened. What he wants is facts and costs, and he wants them by comparison. With other things in the same line, so I should say make all explanations in the simplest and plainest terms possible. B. T. U., K. W., etc., can be reserved for the laboratory, the engineers, or the inner sanctum of the manager's office. To diverge once more:

The liberal distribution of literature, or, in other words, advertising matter, is a great adjunct to the canvasser. It introduces the subject and prepares the mind of the prospective consumer. So when a real pleasant, earnest and agreeable canvasser appears upon the scene he is more apt to be given a studious and respectful hearing. A great deal might be said here about advertising, but as so much is being said and written upon the subject, I shall pass it by, and simply say, like Rudyard Kipling, "But that is another story."

Perseverance is an essential, and therefore an important factor in our art of canvassing. Yet I would not recommend it to the point of insistance, which is often mistaken by many persons for the same article. There is a marked distinction between the two. A canvasser may persevere in securing a consumer or a prospective purchaser. When the consumer or purchaser hesitates or is in doubt, or tells him to call again, or says he will consider the matter, under these circumstances the door (so to speak) is left open. But do not insist; insistance is apt to make a dissatisfied customer, and such, no light company wants, then insistance makes a man appear in the light of a bore, and when a man is really a bore, the fact is generally discovered with electric promptitude.

The canvasser should study to possess himself with what the French call tenue, the definition of which (in the English) is equivalent to restraint, order, measure, style, conscientiousness, intention in demeanor. Being so possessed, he is bound to be discreet, and to succeed he must be discreet.

If a canvasser does no more than make a favorable consideration he has done good work, it leaves him, to repeat myself, the open door, the opportunity to call again. But if the party interviewed flatly and decidedly says he does not wish any further consideration, drop him and let him send

for you when he needs you, then meet him cheerfully, do not refer to his former state of mind, again persevere, but do not insist.

Insistence may do for the book agent; leave that to him. Sometimes, not often, it may do for the drummer or traveling salesman, he may by this means sell a merchant some line of goods with which he is not familiar, by really insisting upon the merchant taking them on trial, to be returned, if not found salable. But with our line of business this will not do, these men, the book agents, or the drummer, may never meet their customer again. Not so with our business. The person cannot return the gas or current consumed, and besides, from this time forward we are to see our patron at regular intervals, through the medium of the statement taken, the collector, or he, or she, may make regular monthly visits to our offices, and thus we become acquainted with them, and in small towns and cities often intimate. We are receiving their money and they are parting with it. To become thoroughly acquainted with a man in a business sense one must either receive from or pay to him money.

A young married woman was once asked by a girl friend how and when she first got acquainted with her husband. The reply was, after she had been married, just two months, which was the first time she had asked him for money.

Now, when you ask people for money you generally have to show some good and sufficient reason for doing so. All of this brings me to another feature of canvassing, and that is the necessity of full explanation as to the rates the company charges for the commodity they furnish. Be explicit in this respect, if it is the price of gas per M. C. F., electricity per M. watts, the cost of running a service, the price of a range set up or anything else. Make it plain; be sure that the new patron understands all these. If you do this you will save lots of trouble for the collector, or for the office, as the case may be. Do not be too hasty or over-zealous; take plenty of time, but do not waste it, neither by procrastination nor undue haste. Here is where you are to exercise patience; remember the old saying, "The longest way around is often the shortest way home." Time and patience may sometimes seem sacrificed, yet oftener than otherwise it will pay to make the sacrifice, if by so doing you can secure new and profitable business friends, and especially if you can retain the older ones. But you may ask what has this to do with the art of canvassing. My answer is, everything, for canvassing does not consist in the mere getting of new consumers, for I have found it often necessary to re-canvass with old friends. In such cases it is necessary to bring all your arts to bear upon them. If a man claims that he has been systematically robbed, that the methods of the company are unbusiness-like and unjust, and you can convince him of the error of his opinion, you have saved him as a consumer, which often requires greater tact or skill than it did in the first instance. Here is the opportunity of the canvasser. Here, if he is possessed of it, he can display what Edison calls his greatest faculty, that of seeing what should be done, and knowing how to do it.

One of the greatest obstacles that the canvasser has to meet with is the dissatisfied consumer (if the person happens to live in the vicinity of his work). As a small grain of arsenic will poison a well of water, so it often happens that a complaining man or woman will spoil what appears a good chance to do good business. Now I should say if this person is near by, hunt him up, and if possible find out what is the cause of his trouble.

I recall a case of this kind in my own experience. I had been canvassing for two days in a certain section where a few persons had made application for an extension of street mains. As it was necessary to make a showing of more profitable business than seemed to be in sight, I was sent out to see what could be done. I got along swimmingly the first day by calling on the residents and having a heart-to-heart talk with them, telling them that on the following day I would call for their signatures for service orders, etc. Everything looked rosy, and I was, as the New York politician says, "cock sure" of getting about every house in the two block run. So I returned to a late dinner and an early pillow. The next day when I returned to the scene of my expected coup I was rudely aroused from my slumbers by the intelligence that there had been a change of heart—that there were some things that would have to be explained; that a Mrs. Blank, that lived in the third block where an extension was being made, had had a meter set and a gas range put in; that she had gone to work with beautiful visions of light work and real economy, but that after a few days she had found she had been using gas at the rate of 25 cents per day, and this lady was advising her neighbors to look well to what they were doing before they were caught in the same kind of a trap. Here was a stunner for you. I, of course, knew there was a mistake, or a big leak, so I dropped the canvassing business for the time and hunted up the cause of the report. When I called upon the lady she said she was glad to have me call, as she was sure there was something radically wrong. I agreed with her. The meter had been set and in use only a short time. The man that placed it had given her a statement, so I had this to start from. I called the lady to read the meter with me, which she claimed she could do. On reading the meter I found that she had been using about 50 feet per day at a daily cost of 5 cents. You see, this lady did not quite understand how to read the meter. I then told her what I was doing in the vicinity, and that I had ceased operations on account of the 25-cent per day statement. She promised that she would set that right, that she would explain her error to her friends and neighbors, and she did, after which I succeeded in getting the signatures of all but three persons in the two block run. And when another man in the employ of the company that makes a specialty of selling gas ranges went into the district he sold more than the usual percentage of ranges, and at the same time got service orders from the three houses that I did not get. I relate this circumstance to show the necessity of following up in an agreeable manner a disagreeable report. I am fully of the opinion that this particular district will prove alike profitable to the gas company and the consumers.

For me to undertake to give any set rules for this work would be useless. Every canvasser and every prospective consumer has his own peculiar character. Each one is a law unto himself. As a canvasser comes in contact with the masses his very existence broadens, his ideas multiply, his vocabulary increases, his interest in his work, his interest in his employer's business and his interest in the welfare of the patron or consumer becomes common and identical.

In his relations as between the corporation and the consumer he must ever remember that the relationship is like unto the law of hydrostatics, whereby two bodies of water of different levels when brought into free communication finally find a common level. They become, so to speak, united, and therefore mutual in interests.

To sum up, I can at best but give impressions. Therefore I would say that the things that impress me as being essential to success in this line, and they are essential in many other lines, are politeness, patience, confidence, truthfulness, courage, honesty of purpose, adaptability of his surroundings, and to the people he meets with, the ability to show things clearly and make them understood. In this a vast amount of patience must be practiced. With these qualities developed the canvasser becomes possessed of confidence, which is his sure foundation and support.

I thank you for your kind attention. If you, my fellow members, can find anything in what I have here written that will prove of any value to you, I shall be fully repaid for the little time expended in the preparation. The business of the world moves so rapidly in these days that it is with doubt that one can claim anything to be new, and therefore it may be that what I have here said is very old to you, nevertheless, "a good old song if sweetly sung may sound as good as new."

SOME ECONOMICS IN HIGH PRESSURE GAS TRANSMISSION.

By Edward A. Rix.

Mr. President and Fellow Members of the Pacific Coast Gas Association:

Last year I had the pleasure of presenting for your consideration a paper entitled "The Compression and Transmission of Illuminating Gas," in which the general theory of the subject was discussed, and methods shown for calculating the specific heats of various gas mixtures, the heat developed by compression and the power required. Also various losses in pressure and power in pushing gas through pipes, and some co-efficients for all this data, so that one could approximate, with some degree of certainty, the various elements of a practical plant. The length of the paper did not permit of bringing it to such a closing that those not caring for the theoretical part could readily solve some every day problems pertaining to a high pressure gas transmission. It is, therefore, the intent of this paper to briefly supply this deficiency, and at the same time to introduce the element of cost of compressing gas and a method for determining the proper size of pipes so that the gas engineer may be able to readily and easily arrive at the essential elements in his problem.

Curve sheet No. 20 has been constructed for this purpose and conditions as general as possible have been assumed, and in order that it may be easy for anyone to construct a similar curve sheet for other conditions, the method of making it may well be explained. Inasmuch as gas is generally sold and handled by the 1,000 cubic feet, it seems proper to make that the basis for quantity, and 1 cent per kilowatt hour seems a natural base from which to calculate the cost of power, and should any one have steam power or power other than electric, it is a simple matter to convert it to kilowatt hours.

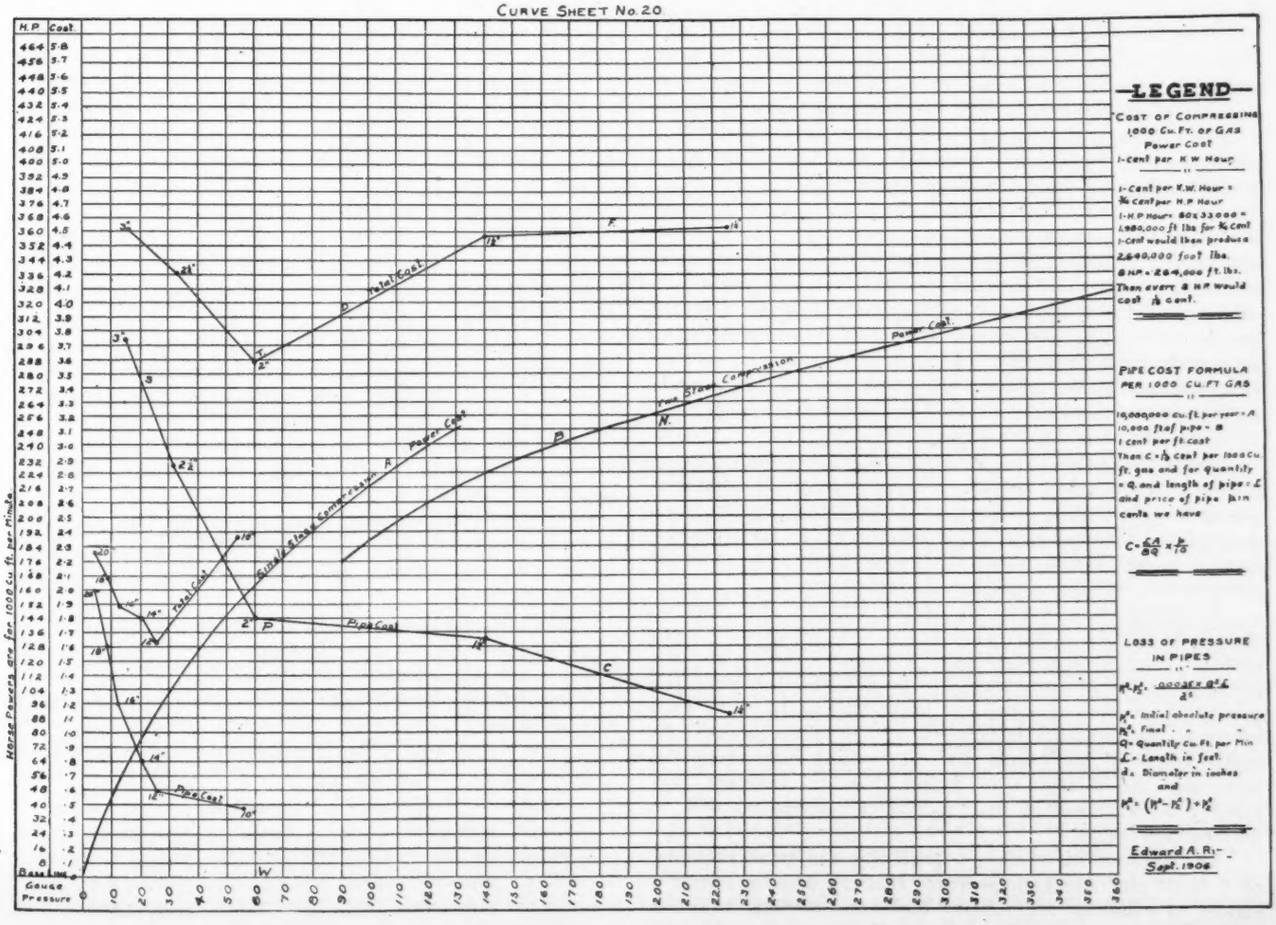
If a kilowatt hour costs 1 cent, a horsepower will cost practically three-quarters of a cent, one horsepower hour = 60x33,000 or 1.980000 foot pounds for ¾ of a cent, 1 cent would therefore produce $\frac{1,980,000}{.75} = 2,640,000$ foot pounds.

Eight horsepower equals 264,000 foot pounds, consequently every 8 horsepower will cost 1-10 of a cent per minute. This gives us the basis for our curve, for if we lay out our sheet in equal divisions of any size and call each one along the vertical line 8 horsepower, we can also make each division represent 1-10 of a cent, and each horizontal division we can conveniently call 10 pounds.

If you will now refer to Table 19, the last table which I read at our last meeting, it will be possible to construct the curve, remembering that the table is constructed for 100 cubic feet per minute the horsepowers therein contained must be multiplied by 10, for the 1,000 feet capacity we are now considering.

Take for example 50 pounds gauge pressure, the brake horsepower required for 100 cubic feet is 14.56, and for 1,000 would be 145.6. Where the vertical line indicating 50 pounds meets the horizontal line drawn from 145 horsepower will be a point on the curve. Similarly other points can be made, and joining the points together, we shall have a cost and power curve combined which will be very useful in our calculation.

I have constructed two of these curves, A and B. A is the curve of single stage compression and B for two stage compression. Single stage is rarely used beyond 100 pounds pressure, nor two stage below 90 pounds pressure. You will note quite a difference in favor of two stage compression. For example, at 100 pounds pressure it costs 2.35


CURVE SHEET No. 20
H.P
Cost
Horse Powers are for 1000 Cu. ft. per Minute
Base Line
Gauge Pressure
Total Cost
Pipe Cost
Power Cost
Single Stage Compression
Two Stage Compression
LEGEND
COST OF COMPRESSING 1000 CU. FT. OF GAS
Power Cost
1-Cent per K.W. Hour
1-Cent per K.W. Hour = ¾ Cent per H.P. Hour
1-H.P Hour= 60x33000 = 1,980,000 ft lbs for ¾ Cent
1-Cent would then produce 2,640,000 foot lbs.
8 H.P. = 264,000 ft. lbs.
Then every 8 H.P would cost ¼ cent.
PIPE COST FORMULA PER 1000 CU. FT GAS
10,000,000 cu. ft. per year = A
10,000 ft of pipe = B
1 cent per ft. cost
Then C = ¼ cent per 1000 Cu. ft. gas and for Quantity = Q and length of pipe = L and price of pipe P in cents we have
$C = \frac{6A}{BQ} + \frac{P}{75}$
LOSS OF PRESSURE IN PIPES
$P_1^2 - P_2^2 = \frac{.0004 Q^2 L}{d^5}$
P_1^2 = Initial absolute pressure
P_2^2 = Final " "
Q = Quantity Cu. Ft. per Min
L = Length in feet.
d = Diameter in inches
and
$P_1^2 = (P_1^2 - P_2^2) + P_2^2$
Edward A. Rix
Sept. 1906

cents per 1,000 for two stage and 2.75 cents for single stage. In even a small plant using 50,000,000 feet per year, the difference would be $200 per annum, which is well worth saving

The two stage curve may be readily constructed from the single stage curve by remembering that the intermediate absolute pressure between the stages is a mean proportional between the initial and final absolute pressures, and, inasmuch as it takes the same power for each stage, if we double the power required for the first stage we shall have the desired results, thus the intermediate gauge pressure for 200 pounds pressure will be 41 pounds. We note from the single stage curve that 41 pounds requires 128 horsepower, consequently twice this is 256 horsepower, which, laid out on our curve sheet on the 200 pound vertical line, will give us the point N. on the two stage curve, and so on for other points to complete the curve.

It must be understood that the horsepowers are for 1,000 cubic feet per minute, and the cost will be per 1,000, and if you wish to eliminate the element of time just multiply the horsepower by 33,000 and the result will be the foot pounds to compress 1,000 cubic feet of gas, and independent of time.

If power costs more or less than 1 cent per kilowatt hour, or the quantity to be compressed is greater or less than 1,000 cubic feet per minute, the results may be read from the curve by simply using a corresponding proportion, for example:

The curve shows that 1,000 cubic feet can be compressed to 20 pounds gauge pressure at the cost of 1 cent, it follows, therefore, that 2,000 cubic feet can be compressed to 20 pounds for 2 cents, or if power costs 2 cents per kilowatt hour instead of 1 cent, then only one-half the quantity can be compressed for 1 cent, or double the quantity if power costs but ½ a cent a kilowatt hour. This method of proportion, however, does not apply to the matter of pressure, for you will note that while a cost of 1 cent gives 20 pounds pressure, a cost of 2 cents gives 58 pounds pressure, and a cost of ½ a cent gives only 8 pounds pressure. In other words, it costs just as much to compress gas from 0 to 8 pounds as it does from 8 to 20 pounds, and just as much to compress from 0 to 20 pounds as from 20 to 58 pounds. It would be well right here to consider this fact, for it has a great bearing on high pressure transmission.

If it was found, for example, that it was costing 1 cent per 1,000 to deliver gas through a certain pipe at 20 lbs. pressure, and it became necessary to double the pressure in order to supply an increased demand, the gas company might consider it inadvisable because it might double the cost. Consulting the curve, it will be seen that the cost for compressing at 40 pounds pressure is only 1.6 cents per 1,000 cubic feet instead of 2 cents, as may be imagined, and this fact might justify the increased pressure, and the higher the pressure the more the seeming disproportion.

From the curve take a geometrical progression of gauge pressure, 5-10-20-40-80-160-320, and we note the corresponding costs of compression for 1,000 cubic feet to be, in cents, .3-.575-1.00-1.6-2.4-3.-3.9, in other words, while the pressure from 5 to 320 has increased sixty-four times, the cost of compression has increased but thirteen times.

It must not, however, be hastily inferred that because of this decreasing power ratio that it is economical to compress at high pressures, because it may not be so and depends upon the amount of gas to be pumped, for while the rate per 1,000 may be small and make no material difference where a small quantity is pumped, with a large quantity the total amount of the yearly cost of pumping may exceed so materially the interest and depreciation on a larger pipe using a lower pressure that the latter installation will be deemed preferable.

The question of whether a large pipe and small pressure, or a small pipe and high pressure shall be used is simply a matter of equating the relative costs of pumping, together with the interest and depreciation on the plant, and, with the curve given herewith, it may be easily determined, and it is to show how to make this determination quite accurately and simple that I have written this paper.

It has seemed to me that the cost of attendance, buildings, laying out pipe, etc., for any one problem may be neglected, for while it is an item of cost, it will be practically the same for whatever pipe you may select. We can then make our comparison, using the market cost of pipe and the cost of power only, to which may be added the other costs after the size of the pipe is determined, in order to give the total cost per 1,000 for handling the gas.

The power and cost curve, as constructed, can be called "Standard" and white prints made from it, and upon these white prints the pipe curves laid out, as will be shown, and this same white print can be used in all cases. Let us then take two examples, one for small quantity and one for large quantity, and before starting at it let us make a general standard formula, which will simplify many of the calculations.

No plant will pump less than 10,000,000 cubic feet per year, which is about 1,200 per hour, or at a less distance than 10,000 feet, consequently take for a basis:

10,000,000 feet per year = a
10,000 feet of pipe = b
1 cent per foot cost of pipe
10 % per annum interest and depreciation on the pipe.

Then equating these quantities we will find that the pipe cost C for 1,000 cubic feet of gas will be 1/10 of a cent.

For any other quantity Q, and length of pipe L, and price of pipe P, we shall have:

$$\text{Pipe cost per 1000 C} \frac{L\,a}{b\,Q} \times \frac{P}{10}$$

Example 1—50,000,000 cubic feet per year, or 6,000 per hour, 50,000 feet of pipe, and power to cost ½ cent per kilowatt hour, substituting in our formula

$$C = \frac{L\,a}{b\,Q} \times \frac{P}{10} \text{ we have } C = \frac{50{,}000 \times 10{,}000{,}000}{10{,}000 \times 50{,}000{,}000} \times \frac{P}{10} = \frac{P}{10}$$

That is to say that whatever size pipe we select the pipe cost per 1,000 cubic feet of gas will be 1/10 the market cost of pipe per foot.

Taking the market prices of to-day, then if we should use:

1¼ pipe, cost per 1,000 cubic feet, equals..... .559
1½ pipe, cost per 1,000 cubic feet, equals..... .67
2 pipe, cost per 1,000 cubic feet, equals..... .894
2½ pipe, cost per 1,000 cubic feet, equals.....1.429
3 pipe, cost per 1,000 cubic feet, equals.....1.875

Having thus blocked out the matter of pipe, we must find what pressure it is necessary to use to pump the gas through these various sized pipes, assuming always that the terminal pressure shall be one pound gauge.

You will remember that we developed a formula in my paper, read last year, which may be used here with accuracy.

$$P_1^2 - P_2^2 = \frac{.00035 \times Q^2 L}{d^5} \text{ where } P_1^2 - P_2^2$$

is the difference between the squares of the initial and final absolute pressures.

Q is the quantity of gas in cubic feet per minute.
L is the length of pipe, in feet.
D is the pipe diameter, in inches.

Substituting in this equation the elements in our problem, we have:

$$P_1^2 - P_2^2 = \frac{35 \times 100 \times 100 \times 50{,}000}{100{,}000 \times d} \text{ or } P_1^2 - P_2^2 = \frac{175{,}000}{d^5}$$

Then $P_1^2 - P_2^2$ equals for

1¼ pipe.....57,370
1½ pipe.....23,000
2 pipe..... 5,500
2½ pipe.....1,800
3 pipe.....700

P_2 being our final pressure 1 lb. or 15.7 lbs. absolute makes $P_2^2 = 246$, and remembering that $P_1^2 - P_2^2 = (P_1^2 - P_2^2) + P_2^2$ we have

1¼	pipe	P_1^2	absolute	=57,616	then	P_1	gauge	=225 lbs.
1½	"	"	"	=23,246	"	"	"	=140 "
2	"	"	"	= 5,746	"	"	"	= 61 "
2½	"	"	"	= 2,046	"	"	"	= 31 "
3	"	"	"	= 946	"	"	"	= 16 "

Now we are ready to put all this on our curve sheet in order that we may have a graphic representation of the situation. The power cost curve is on a basis of 1 cent per kilowatt hour, if, therefore, we plot any other costs on this standard sheet, they must be increased or diminished by the ratio the actual power cost bears to the standard power cost of 1 cent per kilowatt. Our problem calls for a power cost of ½ cent per kilowatt hour, consequently we must plot in our pipe costs at double their real amount, for the standard power cost curve is double the cost stated in our problem. Take then the 2-inch pipe. We have found the pipe cost to be .894, which multiplied by 2, equals 1.798, and the initial pressure required is 61 pounds. If then we lay off the point P on the 61 pounds pressure ordinate and opposite the cost Line 1.798 or 1.8, we shall have the two-inch pipe established, and similarly we can establish the other points, and joining them by lines we have a pipe cost curve S. C., which shows the cost of pipe per 1,000 cubic feet of gas for all sizes from 1¼ to 3 inch. It is evident that the total cost of pumping the gas is the pipe cost plus the power cost, consequently if we add the pipe cost curve to the power cost curve, we shall have a curve of total cost. Take the 2 inch pipe once more, and with dividers measure off the distance W. P., the cost of the pipe line, and add it to the line W. Y., which is the power cost, and we have the point T., as the result of the addition. Do the same for the other sizes of pipe, join these points by lines, and we have the curve D. F. as the final result, showing the combined power and pipe cost per 1,000 cubic feet of gas for all the sizes of pipe under consideration.

It is evident at a glance that the 2 inch pipe shows the least cost, consequently the solution of our problem is 2 inch pipe at 60 pound initial pressure. Total cost per 1,000 3.6 cents on a basis of 1 cent per kilowatt hour, but as our power costs ½ a cent per kilowatt hour, the total cost is 1.8 cents per 1,000 cubic feet of gas.

The graphical method is very satisfactory, for one can see at a glance the relations between the various elements, for example: You will note that it cost practically the same to pump this gas through a 1¼ inch pipe at 225 pounds pressure or a 1½ inch pipe at 140 pounds pressure or the 3 inch pipe at 16 pounds pressure, which is interesting.

Problem Two.

Take 5,000 cubic feet per minute, 300,000 per hour or 2,500,000,000 per year through the same length pipe as in our former problem, and at the same power cost per kilowatt hour. The pipe being the same length and the quantity fifty times greater. We will have $\frac{P}{500}$ for pipe cost per 1000 where we had $\frac{P}{10}$ formerly and taking pipe casing prices up to 12 inches, which was the largest I could get, and assuming them above that size simply for illustration, we find the following prices per 1,000 feet of gas for these pipes.

10 inch	equals	.25 cent	per 1,000 cubic feet of gas.
12 inch	equals	.30 cent	per 1,000 cubic feet of gas.
14 inch	equals	.40 cent	per 1,000 cubic feet of gas.
16 inch	equals	.60 cent	per 1,000 cubic feet of gas.
18 inch	equals	.80 cent	per 1,000 cubic feet of gas.
20 inch	equals	1.00 cent	per 1,000 cubic feet of gas.

and the respective pressures necessary to force the gas through these pipes to be:

10 inch equals 53 pounds.	16 inch equals 12 pounds.
12 inch equals 26 pounds.	18 inch equals 8 pounds.
14 inch equals 20 pounds.	20 inch equals 4 pounds.

Multiply the pipe costs by 2 and transferring those quantities to our curve sheet, precisely as we did in the other problem, we have a pipe curve. E showing the pipe cost per 1,000 cubic feet, and adding this to the power curve, we have the final result in the curve F, which shows this rather surprising fact, that the 12 inch pipe is the best, and that it will carry this gas at 26 pounds pressure, and at a cost of 8/10 of a cent per 1,000 for power and pipe.

The curve shows also that the gas can be put through the 10 inch pipe at 53 pounds pressure at the same cost as through the 20 inch pipe at 4 pounds pressure. I believe this graphical method will be of service to you, particularly as these curve sheets can be filed away and always used for quick reference, for the eye can take in the whole relative situation at a glance. I believe this method of handling the subject removes it from the realm of speculation, and makes an orderly comparison of power and pipes possible, to the end that an adequate selection can be made.

SHOULD GAS COMPANIES ENGAGE IN THE SALE OF GAS APPLIANCES?

By W. B. Cline

As a general proposition gas companies **should** engage in the sale of gas appliances until the use of gas fuel becomes practically universal, but no longer. The length of time required to reach this happy condition depends largely upon the price of gas as compared with the price of other fuels, the climatic conditions, the value placed upon convenience and cleanliness by fuel consumers, and the energy and liberality of the gas company.

If, prior to gas becoming the practically universal fuel, the appliance business is wholly entrusted to regular dealers, the growth of the business will be very slow as compared with the result if handled solely or partly by the gas company. For the dealer has no particular interest in the sale of gas appliances, and furnishes his customers with appliances consuming whatever fuel they desire. Having sold the appliance the dealer's interest in it practically ceases. This is not the case with the gas company. Its interest lies in selling every gas appliance possible, and in seeing that the appliances are kept in good order and used after their sale.

Even after gas has become the universal fuel it may be necessary for the company to handle appliances in order to meet the competition of a rival gas supplier. The latter, in order to secure customers, may offer appliances on such advantageous terms that the company will be forced to meet these terms to protect its gas business proper.

One very important advantage to a gas company in not handling appliances is that contact with consumers is thereby minimized. Dissatisfaction with the time taken to fill an appliance order, or the manner in which the work is done, or the amount of the bill therefor, is often the cause of the consumer treasuring up a grievance against the company, although he is well satisfied with his treatment otherwise.

As the gas company in Los Angeles reached about the first of last year the point where gas fuel became practically universally used, it seems as if I could not do better than offer its experience in proof of the correctness of my conclusion expressed at the beginning of this paper. For fifteen years the company handled appliances on a large scale,

and to promote their sale offered ranges, water-heaters, appliance connections, house piping and plain lighting fixtures at cost, for cash or on installments of $1 per month; other appliances at cost, for cash. The installment plan was a tremendous booster to the business. Weekly free cooking lessons were given in a well appointed hall, an attractive salesroom was maintained, solicitors made house to house canvasses, and newspaper and other advertising was resorted to. Particular attention was given to houses along new mains, and solicitors did not relax their efforts until the use of gas fuel therein had been generally adopted. None but the best fuel appliances were handled, and orders were promptly attended to. House piping and plain lighting fixtures were placed only in premises which would not otherwise have been equipped for gas lighting, this fact being fully understood and our policy concurred in by gas fitting firms. On account of the low prices and liberal terms of payment offered by the company, there was no incentive for other stove dealers to push the sale of gas appliances; several of the dealers carried them, but naturally made but little effort to sell them.

During this period the company was burdened each month with attending to, in addition to legitimate appliance complaints, hundreds of trifling complaints, which the consumer should have remedied. The people had become so accustomed to depend upon the company to cure the slightest fault in the operation of their appliances that they did not hesitate to even frequently ask to have their burners regulated or their appliances cleaned. This entailed a very considerable expense upon the company.

About two years ago the company concluded that the time was rapidly approaching when the use of gas would become so practically universal that the appliance business could be safely entrusted to the regular appliance dealers. In order that these dealers might be able to obtain a fair profit from purchasers without the latter feeling that they were being quoted prices very high as compared with the prices previously charged by the company, the company raised its prices and abolished its installment terms.

About a year and a half ago the company retired from the appliance business, and the result has been entirely satisfactory. In the principal business section the business is now carried on by two or three exclusive gas appliance stores, practically every hardware store and department store, and many of the large furniture stores. These concerns advertise appliances quite extensively. In nearly every business settlement throughout the residence district appliances are sold and repaired. The appliances offered for sale are, in the main, of high grade, and nearly every make of such appliances is represented. Fair prices are maintained and the principal dealers sell for cash or on installments. The dealers state that they had rather sell gas ranges than coal ranges; that the business is cleaner and less troublesome. Altogether the business is well handled, is on a sound basis, and is booming. Eighteen of the principal dealers are selling in the aggregate an average of about 850 gas ranges per month; including as many more small dealers it is safe to say that the total number of ranges sold per month is at least 1,000. Complaints and repairs are now well attended to, at reasonable charges, by several concerns which make a specialty of this branch of the business. One of the largest dealers gives a guarantee with each stove sold that it will operate properly, and that for one year any necessary repairs will be made free of charge. Probably 95 per cent of the gas consumers use gas for fuel. One prominent dealer recently stated that the gas appliance business had practically brought about his success, and many of the dealers declare that this line has become one of the most important branches of their business. To sum up, there are now dozens of dealers actively pushing the sale of gas appliances, whereas prior to last year the gas company was practically alone in the good work.

BEST METHODS OF PROMOTING GAS SALES.

By Sam P. Hamilton.

One of the objects of this paper, which from the title must necessarily cover a broad field, is merely to invite open discussion and thereby enable the writer, as well as others interested, to obtain more knowledge of the methods which are as varied and successful as there are varied and successful types of gas managers represented in this convention.

A discussion of good business methods for further increasing gas sales should include a statement of the present flourishing conditions of the gas industry made possible by the marvelous amount of energy and ingenuity expended by the engineering profession during the last half century as a result of which processes have been evolved for the production of gas at an enormously decreased manufacturing expense; for the distribution of gas through single distributing systems which furnish immense cities and chains of towns and villages with an ample supply of clean, rich gas of uniform candle power and pressure; a system of complaint service which anticipates defective service troubles and an attitude by the company in general of giving value received and extending every possible courtesy and consideration to the great public who are paying the stockholders dividends and the gas man's salary. This policy towards the public of being "At your service," having been fulfilled in such a perfect degree by the Coast gas companies, has alone made possible the favorable showing by the commercial gas man, the man who steps in at a time when the operating department seems to have reached the culminating point of improved processes and helps to continue the steady and healthy growth of the business through discovering new outlets for the gas product in the lighting, heating and power fields, and applying methods of encouraging its usage.

California climate and the "earthquake clause" have helped to "boost" the local gas appliance men into a place of undue prominence, and while we are so busily engaged in "whooping up" the business all these favorable conditions have made possible, as to quite believe that we are the whole cause of the large business being done to-day, it remains a fact, that the "good service" showing of our company is the responsible factor. With the same conditions prevailing in two companies, I believe that the company having an aggressive commercial department, the company which controls absolutely the sale of gas appliances, searching out all the new avenues and methods of increasing its business and finding new applications for its products, convincing the public by its earnest desire to acquire new business, of its equally earnest desire to give good enough service to hold the old converts, will produce better sales showing and fatter dividends than the company relying for increased business solely of the dealer, who carries gas goods as a side line.

The fact that most gas companies have grown away from the idea that it is necessary to give appliances away or to conduct, at a loss, a department in which the most vigorous campaign methods of advertising and canvassing are used, is only an added reason for the thrifty gas manager not having to depend on the half hearted and often misdirected efforts of uninterested dealers. The argument so frequently advanced for gas companies discontinuing the sales department, that the coal merchant does not have to sell coal stoves to sell coal is perhaps a good one, but we may yet see them reduced to this strait if the gas companies keep their appliance boys busy.

The consumer can hardly expect to receive the same service from a company employing only a force of meter readers and collectors as from a company having a competent force of appliance sales people, repair men, adjusters and demonstrators, intelligent and well fitted to see that every installation is working at the highest degree of efficiency.

The methods by which a gas company may engage in the appliance business, for it is a separate business in itself, so as to most successfully promote gas sales, is open to much discussion. I believe in the organization of a self supporting company, a district entity in the parent company, and not burdened with the cumbersome and expensive machinery of half a dozen departments. Sell all appliances on a regular commercial basis, at a good profit of from 30 to 40 per cent, doing away with all loan and dollar a month propositions, relying on salesmen of ability who are paid on a liberal commission basis. A few dollars may be added to the price of a range, and the consumer will scarcely note the difference, while with the increased profits, the company can afford to pay commissions which will interest really first-class salesmen.

The introduction of gas into a household or into a factory is largely a matter of personal solicitation, and I believe a $1,000 spent in sales commissions is better spent than $5,000 in regular advertising schemes. It is through the employment of competent appliance sales people that the great difference between the sales showing of a company doing a strictly gas appliance business, and the hardware dealer's methods will be shown.

Actual cases illustrate arguments perhaps the best. A commercial gas man was impressed by the fact that coke at $13.00 per ton, and of uncertain supply, was being used as a fuel in the local soft metal industries. Why was this not a great competitive field for the use of cheap oil gas? Selecting a new galvanizing plant in course of construction, the young superintendent of which was keenly alive to any advantage to be gained by the introduction of modern methods, studied carefully the conditions to be faced in substituting gas for coke, with the result that he was given the opportunity to install a set of gas burners under a zinc kettle of eight tons capacity, bricked up in the usual manner. Air blast was furnished from a positive blower, and the burners were of the .....type, twenty-four in number, with individual air and gas cocks. The exact figures resulting from this interesting test were lost in the late fire, but the fact that the melting of eight tons of metal was made in seven and one-half hours time as against thirty hours previously required with coke, that no burning of the metal resulted, and that there was a very considerable decrease in dross, owing to the fact that the zinc was protected from oxidization by passing the products of combustion over the surface, proving the great saving in time, labor and material. It was never claimed that the actual fuel bill for gas would be as low as the coke bill, but when it was shown that the comparatively slight increase was offset by the above advantages, in addition to solving the question of hauling ashes, and it being found no longer necessary to retain a night watchman to control a fire under such perfect regulation, the balance was largely in favor of gas. The monthly consumption of gas under this kettle above averaged over 200,000 feet. The actual sale of burners amounted to only a few dollars, and it was necessary to watch the experiment day and night for a time, and to convince the most skeptical person, the shop workman, of the soundness of a method that decreased labor. The question that arises is whether the ordinary merchant engaged in the sale of hardware and gas appliances, incidentally, could find it worth his while to introduce the many applications, showing such a small monetary return, but great gas sales.

Through constant soliciting, the use of cuts and circulars illustrating industrial installations, gas has been introduced into many of the local galvanizing, babbitt melting, and cornice shops. The use of small tempering, case hardening and annealing furnaces in tool shops, and of gas forges, and tire setting machines in blacksmith shops, also met with favor, but at the present time, we have no large installations of this sort, as the shops were destroyed.

All these appliances were used in connection with positive blowers, and a man was detailed to give regular inspection and to see that every installation was kept at a high point of efficiency. Such installations will average from 100,000 to 1,000,000 feet a year, and while the gas must necessarily be figured at a sliding scale, the company is given no more trouble and expense than from the average household consumer. Industrial and restaurant and hotel installations are many and varied, and can be followed with great advantage.

Our salesmen have learned to tell the business man or manufacturer that no matter what line he is engaged in, he can use gas to advantage, and that we will design special appliances for him. Since the fire our appliance company has fitted up nearly a hundred restaurant and hotel kitchens for the use of gas solely as a fuel, making complete installations of ranges, separate broilers, baker's ovens, steam tables and warming closets. There are large sales with consequently large commissions, and our salesmen are very keen on following this line of work.

SOLICITORS AND SALESMEN.

The question of the best method of paying salesmen is one which has been answered in many forms in gas association meetings. Some managers suggest straight salaries, others a basis of combination salary and commission on appliance sales, while others believe in paying on a basis of gas consumption, six cents per 1,000 cubic feet for all new business turned in. In Denver a district system was tried, each man being paid on the increase in consumption shown in his particular district. Any methods which will help to increase the salesmen's offorts are valuable, as the promotion of gas sales depends so largely on these salesmen.

In our appliance company we have districted the city to conform with our branch office district. Under this plan each district will have an appliance display in the branch gas office, and is being canvassed by two solicitors on a straight 10 per cent commission. These commissions are made payable only after the salesman has made his collection in full, this arrangement obviating any tendency to make misrepresentation or to accept bad credits. These salesmen are given full protection in their territories, excepting in the matter of special lines, such as industrial appliances, radiation and large apartment house installations. On this work three general salesmen are placed.

ADVERTISING.

While placing more faith in the results to be had from personal solicitation, it devolves upon all public service corporations to do a certain amount of newspaper advertising, and a consistently liberal advertising allowance pays in many ways. That a great deal of money can be spent foolishly in cards, pamphlets and circulars is also well established.

The rules that decide a successful newspaper gas advertisement are hard to define. An ad may be very catchy and fail of its purpose. I believe regular commercial rules should apply to gas company advertising—talk gas, quality and appliance prices. I believe in advertising prices always to effect appliance sales. Advertise your cheapest range and water heater, and leave it to your commission salesman to sell the most expensive. We advertise $13.50 gas ranges and water heaters, with the result of getting many inquiries. Our clever salesmen do the rest.

Eighty-five cent, twenty-three candle power gas is also a strong talking point, and we run a series of ads on gas thrift. It is a small point but "At your service" in quotation marks appears in all of our advertisements.

DEMONSTRATION.

We make a regular practice of sending a capable cooking demonstrator to each household shortly after we have installed a gas range. This lady, who is very capable and intelligent, gives full instructions in the use and adjustment of the range and generally prepares a full meal. She also reports defective installations and any causes for complaint.

We are preparing for a series of lectures and public cooking demonstrations to be held twice a week during the month of October.

BULLETINS.

For several months this company published a monthly bulletin, attractively printed in three colors and full of cuts showing new and successful installations of industrial gas appliances, well planned electrical illuminations and signs in the business district. This monthly edition of 50,000 copies was distributed by means of bulletin boxes in the gas offices, meter men and collectors. Most of the expense was defrayed through trade advertisers, who found it a successful medium.

WAGON DISPLAY.

Previous to the establishment of district gas offices, which have given us appliance display rooms in all sections of the city, a portable display house which could be located on vacant street car transfer corners, proved a successful means of interesting many people using gas and current. The house, a shingled cottage, 12x20 feet, was placed on running gears, was brilliantly illuminated at night, and was filled with the latest and best gas and electric appliances in full operation, including instantaneous and automatic water heaters, ranges and electric heating appliances. The profit on the direct sale of appliances more than defrayed the operating expenses of the car and the salary of the demonstrator.

SALESMEN'S CLUB.

Our salesmen and solicitors have for a long time had an organization holding periodical meetings and giving occasional dinners at which talks are made by members and invited guests, who are usually appliance men, manufacturers or men qualified to talk on salesmanship. That these meetings are beneficial and interesting is shown by the regular attendance. The only thing to be said against the club is the name—"The Hot Air Club."

APPLIANCE DEPARTMENT AFTER THE FIRE.

A brief mention of the work done by the Appliance Company in supplying wrecked San Francisco with gas ranges after the resumption of gas service, May 11, 1906, may perhaps be of interest to association members. This date found us with about six ranges of assorted models—the remains of our display stock in one of the branch offices. How we were besieged by hundreds of excited people, anxious to be able to discontinue their sidewalk kitchens and our strenuous efforts to "corral" every range to be had on the coast and to hurry Eastern shipments, seems now only a bad dream. Our office equipment was a pine table and a scratch pad for a set of books. Our fitters wrestled with burned pipe and fittings and our salesmen with irate customers, whose money had been accepted on special models of ranges, delivery of which would frequently be delayed by freight tie-ups. The department manager had no bed of roses and the only pleasing and satisfactory times were when the monthly sales reports were made.

That all San Francisco will shortly be using gas is evidenced by our crowning single order of 5,000 gas ranges to be delivered to the Red Cross Relief Association for the refugee camps.

It is rather a blow to our pride as gas appliance salesmen that it should require a whole townful of broken chimneys to demonstrate the value of gas as a fuel, but as a result of this shake-up of obsolete methods and usages, San Franciscans have learned the value of this great labor-saving agent. Not only in the sale of gas ranges will this fact be attested, but also in the heating of the many new temporary and permanent buildings for which we are placing orders for carloads of gas radiation.

THE AMERICAN GAS INSTITUTE.

By F. H. Shelton, Philadelphia, Pa.

It is with pleasure that I accept the invitation of the officers of the Pacific Coast Gas Association to briefly give to you, in convenient form, the history and purposes of the American Gas Institute, for, believing as I do in the great advantages to all gas men to be gained by the promotion of this new association, I am glad to give you all possible information, feeling certain that the more your members understand about it, the more will their support be enlisted.

The theory of concentration, or of action in united form is as old as the history of mankind, and needs no argument in its justification. It is that theory upon which the new Gas Institute is founded.

For many years it has been realized by numerous men in the business that the several Gas Associations, worthy as they are, were and are yet not getting the results that should be possible, or the better results of working as a united and single organization. I believe that the first public expression of this feeling appeared at the twenty-second annual meeting of the American Gas Light Association at Washington, D. C., in October, 1895. At that time the Committee on Federation that had been appointed in the preceding year to report on some plan of union, through Mr. Walter R. Addicks, a most competent and earnest working chairman, presented an extensive plan in detail for federation of the several associations. While this plan was far short of what now seems desirable and possible, and provided for membership through associations, and not by individuals (which would make a small state association as powerful as the largest body—a great defect), it was chiefly killed, because of the prominence of one part of the plan, that of publishing the proceedings, in quarterly form, by the federation. This aroused the opposition of the gas journals. The first motion on the floor was to indefinitely postpone any action on the report, and in the heated discussion that followed, the question of who should print the proceedings received almost the sole attention of the speakers, and the real advantages of federation were scarcely gone into. The plan was killed and much hard and earnest work of the committee went for naught, and nothing more on the lines of uniting appeared until nine years later.

In the last few years, however, the objections, not to say evils, of the methods attaching to gas association conditions prevailing in the United States, have become more and more pronounced, and so impressed themselves upon me that I concluded to make it the principal feature of a presidential address to the Western Gas Association at its twenty-seventh annual meeting in St. Louis, 1904. My arguments as to objectionable features and possibilities of improvements can best be covered by reading up that address, to be found in the usual published proceedings, and need only be referred to here as going into the lines of the unnecessary duplication of expense by maintaining nine secretaries for nine different associations, the publication of nine sets of proceedings, the other expenses multiplied by nine, and particularly the duplication of gas works by different associations; the setting up of different standards, and the otherwise working, ofttimes at cross purposes. In addition the matter of some jealousies in the promotion, advancement and publicity features of different associations was referred to as an evil that could not be denied.

The above meeting of the Western Gas Association was immediately succeeded on June 15th and 16th by a congress of all of the American Gas Associations, and one of the papers before that congress was upon the subject of gas association work by Mr. Henry L. Doherty. This paper, with the characteristic ability and fullness of the writer, went into the subject at great length and was accompanied by numerous tables, and should especially be read by every one interested in the history of this movement toward a bet-

ter working basis, or who is desirous of becoming familiar in detail with the weakness of methods that many believe are now passing, and with the possibilities of new and united methods that we trust are coming. It may be found in the proceedings of the "Congress of Gas Associations of America," pages 154 to 211. In that paper Mr. Doherty particularly pointed out the various features and phases of the gas business; the unsatisfactory conditions on many points in the manufacturing and distribution departments; the irregularities and inequalities of statutes, legislation, tax valuations, etc.; the lack of standards in and unnecessary varieties of domestic appliances, consuming energy and wasting economies; the differences of opinion as to the justifiable degree of development for gas enterprises, owing to lack of standardized data; the inefficiency of gas literature, and specific reference data on scores of practical gas questions; the lack of sufficient educational facilities for the younger gas men; the lack of support from many gas companies toward gas associations, and the small percentage of income available for association work, compared with the resource of the business. Numerous other criticisms and objections to present methods were pointed out. In contrast thereto an ideal association was outlined from the point of view of Mr. Doherty, whose prime purpose would be the bettering of all such conditions and which ideal plan was most comprehensive and ambitious, in contemplating over and above present features of gas associations' various special departments or sections, such as chemical, producer gas and the accounting, etc., together with company memberships, with dues based on population or output, and many other features believed to be of a progressive nature.

The result of the presentation and active discussion of the two papers, as above, at the St. Louis meeting of 1904, was undoubtedly the awakening of at least the question in the minds of those present, of whether the time had not come when something should be done, and this took form in the appointment of a committee by the gas congress of twenty-four men representing the best elements in the gas industry of the United States, and comprising two members from each of the associations, and three members from the commercial or trade interests at large. This committee was charged with the duty of drawing up a plan—if in its judgment feasible—providing for a single gas association, to be composed of the men engaged in the gas industry of North America. While many men believed that something would come out of it, there were equally many who believed that for various reasons the associations could not be put together, and the committee started off in its work in the face of skepticism in some directions and positive antagonism in others.

It is rarely that anything worth while, and which involves the assimilation of separate interests, is accomplished in short order, and in this case it has taken some two years to get to the results hoped for. But the lapse of that time in a sense was to the advantage of the movement, for undoubtedly the further consideration of the subject by men who had not given much thought to it until it was started up, made many such recognize the arguments for and need and desirability of better association work, and hence become more responsive to the final plan when proposed. Through 1905 the committee labored, and by fall had evolved a plan of merger or union for the American Gas Light Association, the Western Gas Association and the Ohio Gas Light Association, as feasible and desirable, which plan was reported back to the American Association at its meeting in October, 1905; to the Ohio at its meeting in March, 1906; to the Western at its meeting in May, 1906. The report of the committee as to the proposed plan is probably familiar to most of you, and may be found in the published minutes of the respective meetings above, together with the proposed constitution of the American Gas Institute, thus forming.

The committee was but human in feeling a marked sense of satisfaction in finding that (after a full presentment of the plan to each association, first through the Board of Directors, where full discussion ensued, and thence through the board to the association itself, with a favorable recommendation), each of the three associations above, after full discussion on the floor, successively, decided to participate, and each created a committee, authorized and directed to wind up its affairs, and to do everything necessary to join in the Gas Institute. These three committees met in July last and organized the American Gas Institute, under the powers vested in them, under date of July 10th. The necessary steps for the first joint meeting of the three constituent associations were taken or provided for, and at this meeting the first regular meeting of the American Gas Institute will be held in the central metropolis of the country—that is, Chicago—on October 17th, 18th and 19th. Such, in brief, is the formation history of our new association.

It can well be appreciated that it was a most difficult question for the committee to determine how far to go in introducing new features, or in making the association different (that is in what respects and to what degree) from the present associations, with which we are familiar.

The plan of Mr. Doherty in many respects is far beyond that upon which the Gas Institute starts off. While in my opinion the great majority of the features desired by Mr. Doherty are excellent, and in some form or another will ultimately be followed, it is equally my opinion that if too many new and radical features were introduced, the plan would not now enlist the support of the gas industry, which support is, obviously, vitally necessary. The other members of the committee felt the same, and that it would be better, above all things, to first unite and get together. With this step accomplished, a long step would be taken toward doing away with past objections, and the united gas men working in a single organization would be in the best possible position to take up successive features as proposed by Mr. Doherty, or by any one else, and to adopt them, or otherwise, as might seem to them best. And to Mr. Doherty's credit I want to clearly bring out that while the first plan of merger is far short of what he has outlined and desired, he withdrew all objections and turned in to facilitate the general movement in every way.

Generally speaking, the constitution of the American Gas Institute covers an association modeled on largely present lines. As it stands, the having of the one and new association will result in the immediate benefits of concentrated income, minimized expense, single, and no duplication of work by committees on special subjects, and the general advantages of an association of three times the membership of past associations, backing up and standing together on questions of legislation, or other matters that may develop, or where united position is desirable, as in showings at expositions, or joining with other bodies, etc., etc.

Having thus gone on a united basis it will be directly up to the management of the new institute to next steadily progress by adopting new and better features. If company memberships and dues based on population or outputs are desirable, such features will, undoubtedly, be proposed at an early date and adopted or rejected, and so with every other supposed improvement in method or work or purpose. Water will not rise above its level. If it is potentially within the capacity and ability of gas men at large to do better work and rise above past levels, the Gas Institute surely affords the opportunity and easiest channel. If it is not within them, it will be but little more than the old associations under another name.

The dangers arising from the Gas Institute, while not many, should be referred to. An organization sometimes gets into a rut of being run by one set of men. As a rule, this is a compliment to the controlling forces, who are apt to dominate, if the brainiest and most forceful. However, if in the

American Institute such tendency should develop, or a feeling exist that the management is controlled by a clique and nominations are distasteful, the membership at large has complete power to meet such conditions, for under the Constitution 20 voting members can make nominations, aside from the regular Nominating Committee.

The directors also are bound to submit to the meeting any proposed change of constitution demanded in writing by any ten members, and the Secretary is bound to call even a special meeting of 100 members, whether active or associate, request such in writing. The Institute, therefore, is surely a democratic, self-governed body, as far as all reasonable provision to that end can be made.

One danger is that the larger the body the greater the tendency for the individual member to leave the work to be done by some one else, on a general feeling that there are enough workers somewhere or another and that he need not go to any personal effort. Such attitude will be fatal. The mere joining of the American, the Ohio and the Western Associations into one body under a new name will not advance gas association work one iota, unless the membership, that is, the individuals personally, not only continue to do the work that each has done heretofore, but in fact do even more in order to get the benefit of concentrated effort. Most of the members are dependent upon the gas business for a livelihood. The gas business in turn, in some instances, is dependent upon, and in almost every instance is at least benefited by the development of the questions that the Gas Institute will take up. Questions of self-protection against unnecessary and unfair legislation, against inequitable taxation, against unwarranted competition in the face of existing reasonable service; questions of greatly improved efficiencies and economies in operation, meaning more money to the companies and more salaries to Institute members; questions of the value of experimental processes; questions of the education of young men in the business, who in succeeding the present men will be the custodians of the properties we are managing; these and innumerable questions that might be cited should and will receive the attention of the Gas Institute, through its management, officers and special committees appointed for the purpose. It is not only the duty of every member of the Institute to honestly and earnestly give thought to working out and pushing these things along, but his duty as well to honestly and earnestly help by personal willingness to work on committees, investigate designated subjects, etc. More than that, it is directly in the interest of his pocketbook.

The relation of the other associations, such as your Pacific Coast Gas Association, the New England Association of Gas Engineers, and the various state associations, and of other bodies such as the Commercial Gas Association, and the Natural Gas and the Illuminating Engineers, etc., is one directly pertinent.

The committee shaping the Institute gave a great deal of thought to this point, and were a unit in the conclusion that the first step in getting all of the gas bodies, roughly speaking, into concerted position, should be a merger of the three larger ones operating as general associations, without any attempt or thought of the discontinuance of the state and purely district associations. It was recognized that these last two forms of gas organization can do local work and meet local questions to better advantage in many cases than any general body. At the same time, it is manifestly desirable that such associations co-operate and work with the Institute on some mutually advantageous basis, and this has been met, it is believed, by Provision 49, of the Constitution, providing for agreements for co-operation. The entire nature of such agreement has not yet been shaped out, but it contemplates that all of the advantages of membership in the Institute, of alliance with it, of its backing, of its information available, etc., will be available for the state or local associations **in return** for an agreement with the latter, that it will confine its membership to persons directly identified with gas interests within its district, or state, and will consult with the Institute before undertaking any original work, and will do each year in co-operation with the Institute a certain amount of original work.

Under such arrangement the state, or district association becomes entitled to one seat on the Board of Directors of the Institute. It will be seen that with such arrangement, the relationship of the state and district associations to the Institute, will be the same as that of the various states of the Union to Congress at large, the latter being the great governing body, but supported by and working with the individual and local states or associations and without interference with state rights.

In closing the subject of the union of gas associations at the Gas Congress in St. Louis, I made the statement, after the appointment of the Committee to take up the question, that "We can leave with the feeling that the biggest work, and the greatest thing accomplished by this Congress of Gas Associations, is the beginning of a plan, which will ultimately ripen into an organization, bringing together in one body all the gas men in the country. We will do it, gentlemen! The time is nearer than I had dared to believe a few weeks ago." From that time until this, those strong in the belief that uniting was the right thing to do, have given of their time and effort unselfishly, and in a large measure continuously; they feel that their work is now largely done, through the results of this formative period, and that that prophecy has been fulfilled.

In delivering to gas men at large the American Gas Institute, as created and organized and launched, in this year of 1906, it will now rest with the gas men of America to take up this work of progression, and get, under the Institute banner, the bigger and better results that so many believe are in the wood. And, knowing the enterprise, the character, the willingness and the breadth of view of the Pacific Coast Gas Association, it seems to me certain that the Institute will be able to count your Association as one of its foremost and staunchest co-operating supporters.

NOVELTY DEPARTMENT.

By G. H. Hallidge.

Mr. President and Fellow Members of the Pacific Coast Gas Association:

Our Secretary was desirous of a paper written on the novelty department, and having but a small claim on literary ability I could scarcely imagine where to begin. However, under the circumstances, I have endeavored to comply with the request, esteeming it a privilege to assist in any capacity assigned me for promoting the interest and well-being of the association and its members.

During the term you appointed me as editor of the Wrinkle Department many useful articles came under my observation which could not be classed as wrinkles. They were not a contrivance to overcome some obstacle or difficulty encountered, or something hastily constructed to assist or to suit some circumstance or emergency which might arise during an experience that many have passed through, or were contrived and adapted to the time and condition which they were used, but were regular manufactured articles designed and invented to be particularly helpful and valuable to all. They were something new, a novel thing, a novelty, or, in other words, were expected to become generally useful, and finally a necessity.

Such articles as these could only be classed as novelties or appliances. The Stiltson wrench, for instance, will help illustrate this point more clearly. It was once a novelty, now a world-wide necessity. One of these wrenches answers the purpose of several pair of old-fashioned tongs, now obsolete. Also the small open pliers where the jaws can be ad-

justed by the sliding rivet. They will operate from a burner pillar to a three-light meter connection. It has since become a universal favorite carried by every gas man.

Refer the mind back only a few years when the now common pipe dies made their first appearance and were called lightning dies. What a novelty, indeed, what a simple article, yet take into consideration the two-piece dies it supplanted, the continual filing of the end of the pipe and labor requisite to cut an ordinary thread, what a saving resulted from this novelty and how widespread its use became.

Still another of the many hundreds of inventions in the tool department was the tapping machine, designed to tap any size pipe under pressure without loss of gas, entirely dispensing with the old crow-foot and drill, also the gauge, hammer and tap, and the enormous loss of gas resulting from their use. The saving from this invention alone was beyond ordinary comprehension.

The present dry gas meter was at one time a novelty. It was once new, but has since become an absolute necessity wherever gas is sold.

Look back just a few years when the prepayment meter made its appearance. What an idea! It was designed, we understand, to minimize the waste of gas by careless domestics, and to assist the poorer classes to use gas.

The Bunson was another simple novelty. No invention has more value today. It is in many ways improved upon, but the same principle. The gas range received its share of improvement, till now it appears a marvel of beauty, and indispensable to every home.

Therefore the Novelty Department appeals to me as being of special value, as the members for the first time perhaps see some article that is entirely new to them, and it may assist to increase the revenue of the plant they represent or reduce the labor of his men, or cost of material. It may be that he has heard or read of what is on exhibition, but has not had the opportunity to see them for himself to be satisfied. Here the inventions are before them. They inspect, criticize and point out their advantages or explain what seems to them to be their faults or defects. They may even take them to their several homes after the meeting and improve on them and thus benefit themselves and the gas fraternity generally.

Furthermore, the exhibitions have been helpful and valuable, which has been attested in several instances from information received from members themselves. Some have put to practical use the articles seen here, and the manufacturers who have furnished the inventions have secured benefit therefrom, as the articles exhibited pertain to the business of the gas man. They are particularly advantageous, as the members can communicate with the firms or agents after being satisfied with the goods they have seen. Instances have occurred where members prefer not to handle them directly and have brought the subject before the merchants of their respective towns, realizing that their sale of appliances increased their business.

The Novelty Department is also of vital importance to members outside the city, as they have neither time nor opportunity, and their visits short and long between, because their attention is demanded and absorbed in their duty where circumstances have placed them, and invariably the new inventions first find their way to the larger cities, finally to the association

Mention might be made of the various novelties and appliances that have been placed on exhibition for the past year, but as it would be like a repetition of what had been seen, I will with your consent refrain at this time. I might mention, however, that the smaller novelties have in many instances proved the greatest value. Many doubtless remember a few years ago an exceedingly small one, the Welsbach mantle, made its appearance on the scene, and just in the nick of time, when gas men began to fear the advent of the electric lamp, almost immediately it placed the use of gas as an illuminant far beyond their most sanguine expectations, and far in advance of any novelty or invention since the use of gas. It reduced the cost per burner to the consumer and increased the light output and returns, and was, we believe, the immediate and direct result of a better relation existing between company and consumer. Later on we trace the ingenuity of the inventor trying to keep pace with the light-demanding public, and by a combination of these small mantles he contrives the arc of today, produces that beauty in appearance, so neat in construction, the peer of all gas illuminants. And when they passed from the hands of their separate inventors it lightens the darkness of night and transformed it into a brightness that seemed to rival the sunlight of day.

While this is true of the gas novelties for illuminating purposes, I deem it also a duty and privilege to refer to the wonders of the light novelties of electricity—the open and enclosed arcs, those radiant marvels of brightness illuminating the business houses, avenues, and parks of our cities, and a protection to our citizens. The novel incandescent lamp whose display and beauty in the art of decoration and light surpasses any of the wonders of brilliancy and artistic merit the world ever produced. Grand beyond conception, the pen fails to describe, the tongue is indeed inadequate to express, the mind unable to conceive, the transparent beauty and grandeur that this little wonder has produced and will yet eminate from this source of science and skill from the unseen current that passes over the wires and supplies vacancies that no other power could fill, and yet these were but novelties in their day, gradually supplying every requisite demand until the world itself would be at a loss to continue the volume of business now transacted without its use. Not only has this source of light and power worked wonders in large cities, as it were, but the navies and merchant marine of every nation, monster fighting machines of all descriptions, and the immense leviathans of the deep for the world's commerce, and the grand floating passenger conveyances of the rivers, lakes and sea, and the exquisite palace yachts of luxury and peace are all equipped with this means of illumination and power, produced from these novelties.

The increasing wonders that daily press their notice upon us, which are but slight diverges from these departments, is the reproduction of the human voice, preserving it intact to produce it at will years after the tongue that uttered the sentences is hushed in the silence of the tomb.

Last of these inventions being wireless telegraphy, started by the studious college boy, can now flash sentences to and from vessels on the pathless ocean. These few practical inventions surpass by long strides the wonders of the ancients. Even the pyramids were classed as novel, and indeed they are, but they bear no comparison and cannot be classed with the smallest novelties mentioned. They are a wonder only. They were constructed for some reason, perhaps gratified an ambition, but serve today no useful purpose in the world but to be gazed at by the few who have opportunity and means.

The novelties exhibited each year in our association are useful and a comfort. They furnish labor for thousands of people in manufacture and represent capital invested. They were ushered into existence of necessity by ingenious inventors, who denied themselves requisite sleep to bring to perfection their inventions for the comfort and convenience of millions of homes wherever these commodities are sold.

There are novelties in every department—gas range and heating stove, illuminating, meter, main and service, manufacture. Many have also steam plants connected with their works, necessitating steam goods of all description, which have also been on exhibition. Oil burners of various patterns, a general assortment have found their way to this association.

Especially interesting are the ways and means adopted and prevalent with the managers of lighting companies' gas

signs to attract attention to their business. Samples of such are always acceptable and apt to create interest. Many have signs along the street when digging pipe trenches.

Some small and inexpensive novelty thought out by a practical man is sure to attract attention, and to prove of value to many they should be placed among the exhibits of this department.

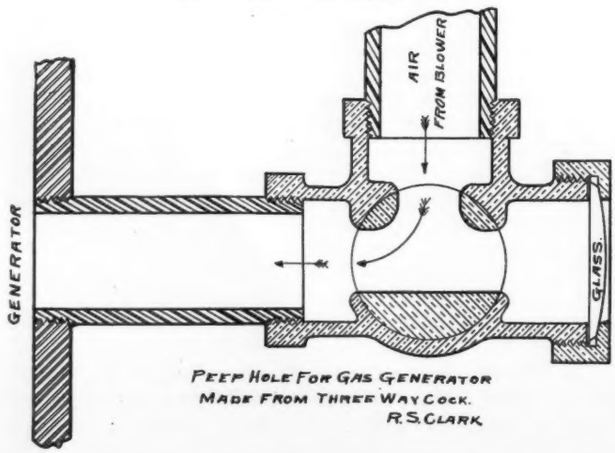
Important discoveries by men of all nations are made every day, and the inventive talent has developed more progress in gas and electric branches than any other commodities on the face of the earth. Scarcely any business carried on today but what the onward march of the ingenious inventor has pressed his way, even to the palatial residences of the wealthy to the kitchen of the most humble artisan, continuing on, recommended by the usefulness, economy and convenience of the article to almost every walk of life. Workshops, factories, stores, hospitals, theaters, barbers, dentists, still onward, not content to abate at the culinary department and the heating and illuminating of our homes, the club room, the train, laboratory, schools and churches, but commences at the cradle and continues beyond the grave, from the heated water of the first bath to the heating of the milk food of childhood, the ironing of the swaddling clothes, the very shoes of boyhood are sewn with the hot wax machine heated with gas, our food is cooked, the canned food soldered, our clothes are pressed, our hats fitted, office and workrooms heated, yes, and in sickness the sterilizing of surgical instruments. In every avenue of life we find the comfort and convenience of these novelties, and in death the very lead or zinc casket is soldered with a gas-heated soldering iron. We are lost for language to further describe the future possibilities of the inventor or the product for their use.

The Novelty Department is also a great object lesson or a combination of lessons. The object lesson with the education of the young in this day is considered most important, because it impresses the mind in a way that no other lesson has power to do. When we come in contact with a novelty or appliance we see it in a tangible form. If machinery, we see it in motion. It presents and unfolds itself to the mind, as it were. We comprehend it immediately. This proves the value of the object lesson and the value of the department.

And now in conclusion allow me to appeal to you, one and all, to think often of this department between the closing of this meeting and the opening of the next, to lend a helping hand to the members who may be appointed to its charge. If you see or read of any new device, however simple, try to secure it or notify the editor. Be not afraid that it will suffer by comparison, for like many men, upon their merit they stand or fall.

WRINKLES FOR THE FOURTEENTH ANNUAL MEETING OF THE PACIFIC COAST GAS ASSOCIATION.

Wrinkle No. 1—A Sight Cock.



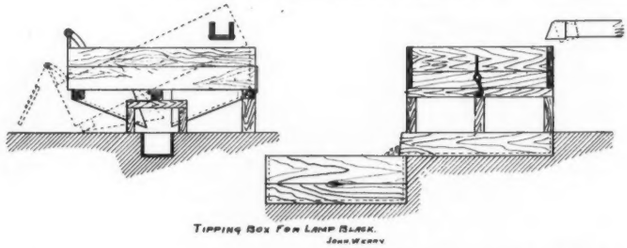
PEEP HOLE FOR GAS GENERATOR MADE FROM THREE WAY COCK. R.S. CLARK.

It is used to clean the sight holes in the gas generator from smoke, enabling the operator to see clearly the heat of the brick. This is simply a 3-way stop cock with the sight on the opposite end that attaches to the shell of the generator, the side outlet of the cock being connected to the blast pipe. When the cock is opened so that you can see through the glass into the generator, the air is also admitted through the side opening of the cock into the generator, and at the same time clears the glass of smoke. By a quarter turn of the cock the air is brought only in contact with the glass and the opening into the generator is closed. This gives the operator a better chance to judge the heat of the checker work and makes a handy device which the operator will use instead of guessing at the heat.—By R. S. Clark.

Wrinkle No. 2—Asbestos Rope for Gaskets.

We formerly had considerable trouble keeping the cover joints on our dry seal purifiers tight, especially when the gas was hot or the pressure high, say from 60 to 80 inches of water. Red lead putty was satisfactory in the days when the pressure was from 20 to 40 inches. Last fall we tried on one purifier an asbestos soft twisted ¾-inch rope as a gasket, and it held perfectly tight with 87 inches pressure. Since then we have satisfactorily used asbestos gaskets on all our purifiers. The asbestos is far cheaper than red lead putty, as it can be used over many times. We are still using the original gaskets, the first one after having been used ten or twelve times looking as if it could be used for another year.—By W. B. Cline.

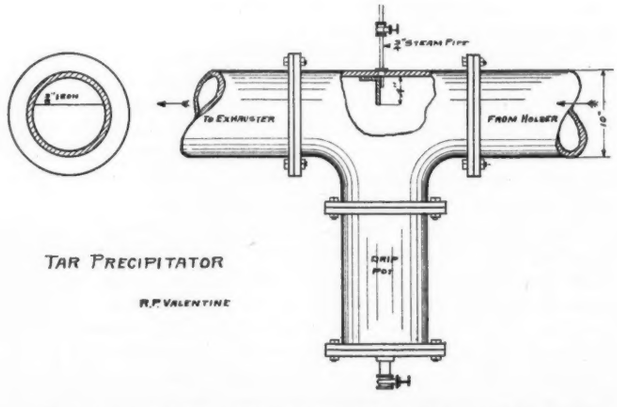
Wrinkle No. 3—Lampblack Separator.



TIPPING BOX FOR LAMP BLACK. JOHN WERRY

This sketch represents a "lampblack catcher," about 5x8x12 inches. The bottom is made of laths, covered with burlap. Into this we have a box from our washer, burlap acting as screen. The water passing from this is clear and seems free from any foreign matter. From here it runs into the regulator settlers and if any is left will catch it there. This insures nothing but pure water at the final outlet to creek, and no kick from the fish commissioners.—By John Werry.

Wrinkle No. 4—Tar Precipitator.



TAR PRECIPITATOR

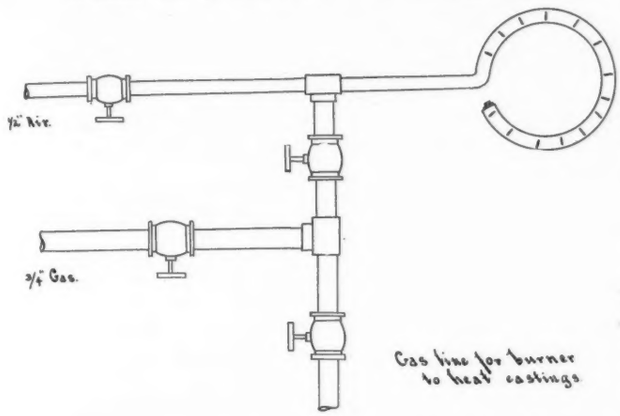
R.P. VALENTINE

In casting about to find something that would prevent tar from accumulating excessively in our exhauster we finally introduced what I have styled a "tar precipitator."

This precipitator consists of a tee inserted in the 10-inch suction pipe leading from the relief holder to the exhauster. Within the tee a piece of ⅜-inch boiler plate iron made in the form of a semi-circle is suspended to the upper side of the pipe, directly over the center of the outlet of the tee, as shown in the cut. This acts as an interrupter, which changes the flow of the gas and tends to throw down the tar.

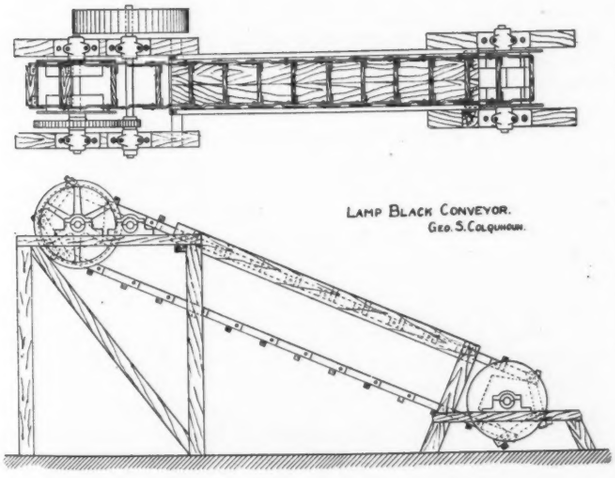
To the lower portion of the tee is attached a short piece of flanged pipe of the same diameter, which acts as a receptacle for the accumulated tar. A blank flange tapped for a 1½-inch pipe with an outlet valve serves as a bottom. The steam was introduced as a means of purging out, if necessary.—By R. P. Valentine.

Wrinkle No. 5—Gas Burner for Melting Lead.



Having occasion to melt a large quantity of lead in a pot 16 inches in diameter and 10 inches deep, a piece of ¾-inch pipe was bent in a circle and the end capped; slots were then cut with a hacksaw. To this a ¾-inch gas pipe was attached with gas under 5 pounds pressure, and a ½-inch pipe from compressed air tanks. By regulating the air and gas valves, 10,000 pounds was melted and poured in four and one-half hours.

Wrinkle No. 6—A Lampblack Conveyor.



This conveyor was made to carry lampblack from a lampblack skimmer to a place in the yard and piled up. This machine saves handling about three-fourths of the lampblack by hand. It requires about 7 horsepower to operate it. The length over all is 110 feet.—Geo. S. Colquohoun, Editor Wrinkle Department.

EXPERIENCE DEPARTMENT.

By R. P. Valentine.

Mr. President and Members of the Pacific Coast Gas Association:

There has been a hearty and generous response to the call of the "Experience Department" this year, and an unusual willingness manifested to reply to our request for "experiences," even if it is but to inform us that nothing has occurred worth reporting. With this in mind, the editor desires to seize this opportunity to extend a personal word of thanks to those who displayed so commendable a spirit—commendable not because it has made possible this report, but because it is the spirit that has sprung from the recent disaster and entered the souls of the people of our state, assuring the continuity of our prestige and prosperity; it is the spirit that will make this convention the most successful in our history.

From every hand come reports of the remarkable increase in the gas business all along the Coast. Even those places that suffered most heavily from the earthquake and fire tell of an almost unbelievable development during the past four months. All this speaks most eloquently for itself, and congratulations are due those whose energy has brought about this condition.

The first "Experience," short and to the point, brings up a question.

"On April 18th and 19th of this year we found it to be of decided advantage to live on one of the highest points in San Francisco, as we were able to have sufficient gas to do cooking not only for ourselves, but for a number of our neighbors who lived further down the hill, there being sufficient gas in the pipes to supply our wants until we were obliged to move, on the 21st of April. We had always been told that by living on the hill our gas bills would be extremely high owing to the pressure, but the benefit we received during the days in question more than compensated for any excess that we may have paid owing to the pressure."

How, we must ask, could there be a high pressure when the gas was shut off at the works?

Another "Experience" relates to the earthquake, and is interesting and instructive, notwithstanding the fact that a repetition of the circumstances which prompted the expedient are far from likely.

"On the morning of the shake our entire office force, the meter men, and, in fact, everyone available, were turned out at the earliest possible moment, each being allotted to a certain portion of the town and instructed to make a house to house inspection. The orders were to shut off meters wherever there was a leak, in order to prevent waste and accident. When the leak was found to be on the company's side the office was notified as soon as possible; when it was found to be on the side of the consumer, we notified the plumber, with the customer's consent. Bad leaks were all immediately dealt with, precautions of every kind taken, and warnings freely given. In a remarkably short time we had the situation well in hand, and there was no accident whatever."

The next contribution deserves consideration and shows one of the many schemes to which one wise and expedient gas man is able to resort. The inventor of this surely deserves credit.

"As a collector of back debts, the prepayment meter stands paramount, and I have lately placed them on our force for this purpose, in the following manner:

"There is a slot meter on the market that can readily be altered for any rate per thousand desired, and when it is found that a customer is becoming slow in his payments and has allowed a large balance to accumulate, but is other-

wise a desirable consumer, a prepayment meter is placed on his service, set for a rate 25 per cent higher than the regular rate charged, and the difference, at the time of collection each month, credited to his balance, and when he has caught up, the prepayment attachment is changed back to the old rate, and usually this meter is left as a safeguard against any repetition of this trouble.

"Customers who have been cut off for non-payment and want to come into the fold again can safely be handled in this way and are willing to pay the higher rate till caught up. With a certain class of customers I have found the prepayment meter brings in more revenue than the ordinary kind—they are good things."

But speaking of prepayment meters, we have the following in an entirely different strain:

Trouble With the Prepayment.

"Our experience with prepayment meters has, to put it mildly, been unpleasant and expensive. The first style of meters that we used was very satisfactory, and supposing that all kinds must be reliable, we began casting about for the lowest priced meter, finally settling upon one that had an attachment upon the outside which was comparatively inexpensive, and looked so simple that we thought it the most advisable article of its kind. After several of these meters had been in use we noticed that there was an increasing demand for prepayment meters, and that our consumers generally requested that we set this particular style. Naturally we began to inquire why, and soon learned that while the primary dial would call for a certain consumption of gas, there was nothing like money enough in the cash box to cover the amount. This called for a rigid examination and test, which resulted in finding that the main on shut-off valve of the prepayment attachment was decidedly unreliable, as no matter how carefully we might adjust this attachment, it would be but a very short time before it would leak so much that quite a little cooking or lighting could be done without dropping more quarters into the box; and no matter what we did, the same trouble was constantly occurring. We have also had some experience with our meters being burglarized, and taking all things into consideration, have about concluded that prepayment meters are a poor investment."

This next, entitled "An Experience with Quick Generator Repairs," is an excellent one and will meet your approbation.

"During February last the crown arch of the first cylinder of one of our largest oil gas generator sets burned down. Our daily send-out was so large that we could not get along without this set, so for a time we were in a dilemma.

"Concluding that half a loaf was better than none, we cut out the first cylinder. We then cut a hole 12x18 inches in the cast iron tunnel pipe and knocked out the brick lining; this we had to do, as the center of each alternate brick was over the end joints of the tunnel pipe and the connecting nozzles. Then we rolled out the tunnel pipe and put a blank flange on the nozzle of the second cylinder, and we were ready to make gas, using 120 gallons of oil per run in the cone cylinder, instead of 180 to 200 galions we formerly used with both cylinders. This second was only down about six hours.

"Next we recheckered the first cylinder and put in a new crown arch. At the same time a patch of ⅜-inch tank steel was cap screwed over the hole in the tunnel pipe and it was relined with fire brick, the ends of the brick being flush with the ends of the tunnel pipe.

"During stand pipe cleaning time we took off the flange from the second cylinder, put the tunnel pipe back, and were ready to make gas, this change taking three hours.

"A slow fire had been started in the first cylinder as soon as the brick work was done, the mechanics putting on the cover, stack valve, etc., while the generator was heating up."

The two that follow are similar in their nature and will illustrate the accidents that so frequently befall the gas man and the exigencies to which he is so often put. This one we might call

"How the Waterworks Got Soaked."

"Experiences of a pleasant kind are rather scarce in this vicinity, but I want to relate to you one that was rather expensive and quite unusual and dangerous.

"The city waterworks department placed a blast over an 18-inch gas main and shattered one length of cast iron pipe. The gas blew from the hole very rapidly and we lost many thousands of feet before we were able to fill the hole with mud and cement. We immediately arranged to place bags on either side of this break and remove the broken length of pipe. During this time the gas leakage in the saturated ground was almost unbearable and risky, besides there being danger that someone might set fire to it. In fact, with all our precaution to keep fire from the gas, after our bags had been placed for some time, a man with a pick struck fire on a rock and lit the ground all around. Of course, it is unnecessary to mention any of the remarks that were made in reference to the parties placing the blast over the gas main, which they certainly knew was there.

"We simply lodged our complaint in the shape of a bill, and we consider it very fortunate that none of our men was overcome with gas or burnt.

"I hope that we shall not have to repeat this experience, even for the benefit of your department."

And of the same character the following:

"We had a spectacular and somewhat novel experience some time ago, when a 10-inch feeder between two 12-inch mains, located in the business section of town, was undermined and allowed to fall, resulting in a broken pipe, an immense loss of gas and finally an explosion.

"It happened in this way:

"Contractors had begun digging a deep trench for sewer purposes, parallel to our pipe. With gross carelessness they dug for some distance directly beneath this, without taking the precaution of shoring it in any way. The natural result was that the pipe collapsed, this occurring at 4 o'clock in the morning when, of course, no one was on hand save the contractor's watchman. The latter, scampering for pure air, did not take the trouble to notify us of the accident. Consequently it was not until indications of the trouble were noted at the works that we were aware of anything wrong. As soon as the office opened for business, however, the telephones were kept hot with 'stifling gas odor' and 'no gas' reports in overwhelming numbers.

"When the accident occurred everything at the works—generators, compressors, boosters and exhausters—were turned loose to their fullest capacity, and in our endeavor to maintain some semblance of pressure we shot gas through our mains and out into the atmosphere until 225,000 cubic feet had escaped. And even then our efforts were almost futile, for in that section of town where the break occurred our consumers were barely supplied.

"While every effort was being put forth at the works, our street gang, which had been hastily distributed about town in search of the trouble, were hurriedly collected and set to work. By tapping the pipe at each side of the break and inserting bladders we were enabled to stop the flow of gas to such an extent as to permit work in the ditch. At the broken end the bell was cut off and a sleeve used to make the joint, the pipe being raised with differential blocks. In five hours after the accident gas was again passing through the pipe.

"But this stage in the game had not been reached without something occurring in the nature of a pyrotechnic display. Some gas had escaped about the bladders, passing out the open ends of the pipe and into the air. One of the workmen connected with the contractor's gang approached the

spot where the gas issued forth and, puffing on a cigarette, set fire to the mine. As one of our evening papers exaggeratingly puts it, the flames 'shot one hundred feet into the air.' Luckily no one was injured, not even the cigarette smoker, except for the loss of some hair from his face and head. But there was excitement enough to suggest an earthquake."

Of more practical value than entertainment is the following:

"Experience with a Trapped Gas Main."

"We had a peculiar experience locating a trap in a 6-inch cast iron main. The length of main affected was approximately 5,000 feet. When complaint was made of poor pressure we placed three recording Bristol gauges on the line, one at each end and one at the center of the 5,000 feet of main. At peak load the gauges showed a vibration from one to five inches and about forty per minute; these vibrations showed on all of the gauges, but not so heavy on the end gauges as on the center one. From these conditions the assumption would be that the trap would be on the holder side of the center gauge. We placed U gauges, tapped directly into the main, at different points along the entire main affected. By closely watching these gauges we noticed that the pressure vibrated from a higher to a lower pressure on the supply side of the center gauge, while on the other end the vibrations were from a lower to a higher pressure. By working the gauges to a central point we located the trouble beyond the center gauge near the consumer's end, while the heaviest vibrations were always on the supply side of the center gauge.

"We found the trouble to be a number of small traps where the main had no grade. The greatest amount of liquid that we found in any particular trap was about five gallons of oil and water; the others had from one to one and one-half gallons.

"The peculiar actions noted above, I think, were due to the main being too small for the amount of consumption, there being insufficient volume to maintain the pressure back of the trouble (or at the supply end); and as the water would lash up and partially shut off the main, the consumption would then exhaust the gas in the main beyond the traps and reduce the pressure; then as the water receded the gas would rush forward to fill the space made vacant by the consumption and cause the gauges on the supply side of the trouble to show much less pressure than actually existed, for a great distance back, while on the consumer's end we received a small supply through a district regulator, which acted as a cushion and checked the vibrations at that end.

"The small amount of water in the traps caused the rapid vibrations."

Gas Engine Run of 91 Hours.

The following may conduce to the better information of those who have their doubts as to the efficiency or reliability of gas engines:

"We have two at our works, which we use in connection with our high-pressure system, one being of 38, the other of 90 horsepower capacity. The latter we use only during the progress of the peak load, at which time we shut down the smaller of the two.

"On the occasion when we painted the smaller engine we carried the load straight through for 91 hours with the larger one, without the slightest intimation of trouble of any kind, and from appearances could have continued the run indefinitely.

"While the run is not a record-breaker, it serves, along with the statement that we have run the two engines with perfect satisfaction for nine months, to show that up-to-dae gas engines are entirely reliable and efficient."

The writer of our next experience, our last, has entitled it "More Ways Than One." It serves again as an example of one of the many possibilities in the way of schemes and devices in the gas-making business, and also serves to indicate what we have spoken of before—the magnificent growth of the gas business.

More Ways Than One.

"Our output having grown to such an extent that our mains became inadequate, we determined that the best thing we could do to relieve the situation would be to install a pressure booster.

"This we did some two years ago by reconstructing a No. 7 Sturtevant blower and using a 10 horsepower Otto gas engine to furnish the motive power. This engine and booster has been running about 20 hours daily and giving excellent satisfaction, but like every other mechanical contrivance, occasionally demands repairs. When this booster set was introduced these repairs could be made during the afternoon, but our business has so increased in the past few months, notwithstanding that it is now summer, when a light output has heretofore been the rule, that we were obliged to find other means to maintain the required pressure during repairs. Looking over the situation we lit upon the idea of utilizing our exhauster. This is a self-contained Connersville exhauster and engine, used to pump the raw gas from our relief holder through the purifiers to the distributing holders, and the piping is so arranged that by manipulating the proper valves we are enabled to pump the gas directly into our street mains, after it passes through the purifiers. Thus we can maintain the required pressure on our mains. This arrangement has worked very satisfactorily, and although it would be a risky proposition, we could get along some hours without a storage holder, provided nothing went wrong with our manufacturing apparatus."

RECONSTRUCTION OF SAN FRANCISCO TELEPHONE SYSTEM.

With a view to giving the best service to its subscribers in the "east" district, the telephone company is beginning the work of installing a new multiple switchboard in the "east" office on Hyde street near Sutter. The building was badly gutted by the fire, and the switchboard equipment at that time in commission was totally destroyed.

The material for the switchboard is on the ground and the building has been put in shape for its immediate construction. The equipment is of the latest type, and will have a capacity of 3,500 lines, which will be increased to 6,400 in a very short time.

When completed the switchboard will cost $175,000, which represents but a small percentage of the vast sums of money to be expended by the telephone company in restoring its system. At present the "east" numbers are being handled in the big "main" office on Bush street. It is planned to transfer the connections to the "east" office without in the least disturbing the service of the "east" numbers now in commission. This imposes a huge task and a large additional expense on the company, as it will be necessary to pick out the loose wires and make temporary racks to hold them together pending the installation of the permanent equipment. The work will be completed in seven weeks, and then the "east" subscribers will receive telephone service of the highest efficiency.

Walla Walla, Wash.—It has been announced by the Home Telephone Co. of Portland, Ore., that active construction of their new automatic system will be commenced simultaneously in Walla Walla and Spokane in the near future.

Dawson, Yukon Territory.—Dr. Alfred Thompson has undertaken the establishment of a wireless telegraph service between Atlin and Quensel. The line will be 1,300 miles in length.

The JOURNAL of ELECTRICITY POWER AND GAS
WITH WHICH IS INCORPORATED
The Engineers' Architects' and Builders' News

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Entered as "The Electrical Journal," July, 1895.
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VOL. XVII SEPT. 22, 1906 No. 12

EDITORIAL.

PACIFIC COAST GAS ASSOCIATION

The recent convention of the Pacific Coast Gas Association, held in this city, was one of the best in its history. The attendance from the entire Pacific Coast was large, the accommodations in the present office building of the Pacific Gas and Electric Co. and its constituent companies were ample, the papers presented were extraordinarily valuable and interesting, and the exhibition of gas appliances very instructive, showing the rapid development in the gas industry during the past few years.

This convention, coming as it did, five months to the day after the earthquake and fire, might have been supposed to have encountered difficulties of more than ordinary magnitude. The spirit of the convention, however, was such as to wholly eliminate any thought but the immediate rebuilding of San Francisco and its ultimate development into a greater and more important city than ever before. The assurances of good will and generous support from the delegates to the convention from cities outside of San Francisco were most heartily received. If the entire business and commercial population of San Francisco could have been present, particularly at the banquet, the inspiration given to them would overcome many of the seeming difficulties under which San Francisco seems to be temporarily laboring at the present time.

Among the most interesting papers were those relating in detail how gas and electric service was so promptly and satisfactorily restored after the serious occurrences of April 18th. The work done by the San Francisco Gas and Electric Co., from its highest officer down through the ranks to the laborers and even helpers, during the days immediately following the fire, was not only heroic but extraordinarily effective. The spirit of loyalty and co-operation could not help but bring the best results, and the wise leadership of the engineers of the company, coupled with the good hard work done by the rank and file, resulted in giving to the people of San Francisco gas and electric service in a very short time, considering the extent of the damage done to the sub-stations and distribution systems for both gas and electricity.

The future for the manufacture and sale of gas on the Pacific Coast indeed, seems most promising. The many new types of gas lamps shown in the exhibition room indicate most clearly that for purposes of illumination gas is beginning to be a serious rival of electricity. The Welsbach burner in its varied forms has done great things toward improving the character of illumination possible with gas. The extent to which cooking is done with gas as fuel, particularly on the Pacific Coast, is increasing rapidly. And, finally, it seems but a very short time until power in large quantities will be developed for manufacturing purposes from gas at a cost per horsepower so low as to be equal if not less than the cost of steam or electric power.

Gas companies will undoubtedly soon find it to their advantage to increase their manufacturing plants, enlarge their distribution systems and develop as rapidly as possible new business, particularly where the amount of gas used by individual consumers is large.

The development of high pressure gas systems has been of great importance in enlarging the area which may be covered from each gas station. With proper governors or regulators, the pressure can and is maintained practically uniform during the period of maximum demand, even in remote districts. With the increased field of gas consumption and the construction of larger plants the cost of gas manufacture is necessarily reduced. With a smaller cost of gas in the holder the selling price may be reduced and the natural result will be a much greater consumption, and at the same time a decidedly larger income.

The members of the Association are alive to the advantages which result from increasing the output of their plants and, notwithstanding that some work must be done to recover the ground lost on account of the earthquake and fire, yet the future for the gas interests of the Pacific Coast is decidedly bright, and it is not too much to expect that within the next year there will be a large development, not only in new plants, but a material enlargement of the present installations.

HUNT, MIRK & CO. REMOVAL NOTICE.

Hunt, Mirk & Co. are now located at No. 605 Howard street, near Second, San Francisco, where they will remain until their permanent building at No. 135 Second street is completed.

BOOK REVIEWS.

A Graphical Treatment of the Induction Motor. By Alexander Heyland. Translated from the Second Edition by G. H. Rowe and R. E. Hellmund. 48 pp., 28 illustrations. McGraw Publishing Co., New York Price $1.00 net.

It is hardly possible to investigate any phase of alternating current phenomena by purely analytical methods without encountering highly complex mathematical expressions. The usefulness of the circle diagram as a graphical aid to the analysis of the induction motor is pretty generally recognized. The treatise just issued aims to show how this diagram may be successfully utilized to determine the electrical input, the torque, the output, the slip, and other characteristics of a completed motor. The methods for determining these quantities are clearly illustrated by the drawings, which are preceded in every case by a discussion of the relations which follow as a consequence of the existing conditions. As examples of how these methods may be used practically, the diagrams for a 2 horsepower, a 7 horsepower and a 12 horsepower motor are discussed and drawn. The book contains some interesting diagrams for the induction motor driven as a generator, and a comparatively lengthy discussion of the theory of the single-phase motor. It is evidently intended for those who are already somewhat familiar with the theory of alternating current motors, and will certainly recommend itself particularly to those who desire to become familiar with effective methods for motor testing.

Catechism on Producer Gas. By Samuel S. Wyer, M. E., Member of the American Institute of Mining Engineers, Junior Member of the American Society of Mechanical Engineers. 42 pp., 3 diagrams. McGraw Publishing Co., New York. Price $1.00 net.

This little volume contains answers to such questions as might fairly be put to men engaged in the manufacture of commercial gas, or the handling and construction of gas producers. The first two diagrams show the typical construction of the pressure gas producer and the suction gas producer. The third diagram shows in tabular form the sources of the heat supplied, and the various ways in which heat is wasted in the process of gas manufacture.

Stray Currents from Electric Railways. By Dr. Carl Michalke. Translated and Edited by Otis Allen Kenyon, 98 pp., illustrated. McGraw Publishing Co., New York. Price $1.50.

The corrosion of gas and water pipes due to electrolysis produced by stray currents from the rails of electric roads may prove very destructive, and is a factor which the railway and municipal engineer is obliged to consider. The successful operation of telephone and telegraph systems may be greatly interfered with by the action of these currents. Dr. Michalke has given a comprehensive discussion of the peculiarities of these currents and the measures effective in controlling their action. Their distribution and strength of stray earth currents are for the most part treated mathematically and in a way not difficult to follow. The book is well illustrated. Those who desire to pursue the subject further will appreciate the extensive bibliography which the translator has added.

Designs for Small Dynamos and Motors. By Cecil P. Poole, M. Am. Inst. E. E. 186 pp., illustrated. McGraw Publishing Co., New York. Price $2.00 net.

The book contains considerable data which will be found very helpful by teachers in manual training schools and amateurs who are interested in the construction of small electric machines. The details of field pieces, armature cores, windings, etc., are illustrated by descriptive and working drawings. The list of designs includes direct current motors, dynamos, single phase induction motor, single phase rectifier, and combined alternating and direct current machines, all being of small capacity.

The Technical Dictionary, Vol. I, Elements of Machinery. By K. Deinhardt and A. Schlomann. 403 pp., 823 illustrations. McGraw Publishing Co., New York. Price $2.00 net.

Those who are accustomed to reading technical books and magazines printed in foreign languages are frequently annoyed by running across unfamiliar technical terms which the ordinary dictionary does not define. The Technical Dictionary aims to furnish a reference list of such foreign words as are common in the technical vocabulary. Vol. I, Elements of Machinery, contains the equivalent names in English, French, German, Italian, Spanish and Russian of the ordinary hand tools found in the shop and drafting room, and of the common devices and contrivances which make up the greater part of most machines. A list of words commonly met with in engineering literature is also included. These are defined, not in words, but by illustrations and formulae for obvious reasons. The book contains an extensive index in the six languages which will be found useful in translating from one language into another.

Notes on Electrochemistry. By F. G. Weichmann, Ph. D. 140 pp. McGraw Publishing Co., New York.

A general survey of any particular science is always of great assistance to the student, inasmuch as the facts and principles with which he ought to be familiar are separated from the miscellaneous mass of details and developments in which they are usually found buried. "Notes on Electrochemistry" is an admirable digest of the theoretical principles and their applications in the science of electro-technology. The book is thoroughly up-to-date and is almost exhaustive in its scope. A bibliography of important books and papers bearing on the subject precedes each chapter.

TRADE CATALOGUES.

The Central Electric Co. of Chicago are sending out to the trade a catalogue of condulets and are calling attention to the fact that they are carrying a complete stock of all styles and sizes up to and including the 1-inch. Condulets have been on the market for only a comparatively short time, but have already made a place for themselves and are becoming extremely popular among contractors and wiremen. It is suggested that anyone who has not received a copy write the Central Electric Co., 264-270 Fifth avenue, Chicago.

The demand for a light, whose illuminating power is between that of the arc and the ordinary incandescent, is met by the General Electric Co.'s "Edison Gem" incandescent and meridian units which are described in their illustrated Bulletin No. 4453. A special high grade filament is used which causes a considerable increase in efficiency, and makes the light emitted highly brilliant and steady. The lamps are designed to be used on either direct or alternating current circuits at standard voltages of 100 to 130 volts.

The GE-90 railway motor is described in the General Electric Co.'s Bulletin No. 4454. The motor is rated at 50 horsepower, and is recommended on account of its high efficiency and the ample provision for good ventilation.

Bulletin No. 4455 of the General Electric Co. contains valuable information concerning the construction and operation of their single phase motors of capacity varying from ¼ to 15 horsepower. A table, showing the power which single and double belts will transmit at various speeds, is also included.

After September 1st Otto Neisser, representing the Central Electric Co. of Chicago, will be located at 512 South Broadway, Fifth Floor, Los Angeles, Cal.

INDUSTRIAL.

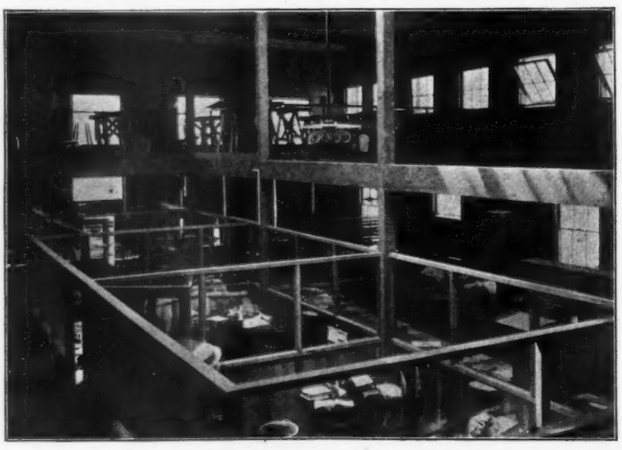
CHAS. C. MOORE & CO., ENGINEERS.

There is probably no large firm in San Francisco that has so energetically from the first made every effort to reorganize their San Francisco office than the well-known firm of Chas. C. Moore & Co. But a few days had passed after the fire before men were secured and work was begun removing the debris from the ruins on their old site at 63 First street. This work required a considerable length of time

on account of the very large stock of machinery which was on hand at the time of the fire, and which, by the intense heat, was melted into practically one large mass.

Long before the work of removing this debris was completed, plans had been prepared for a new office building to be erected at the old location. This building was completed with all possible speed and was occupied by the firm on September 1st. They have arranged their new offices along the same lines as the original quarters, in fact, the present building, being used exclusively by the various offices of the firm, is better lighted and more conveniently arranged than the old offices.

It is the intention of Chas. C. Moore & Co. to constantly carry a considerable stock of machinery of all kinds, ready for immediate delivery, and the building has been so constructed as to allow ample store-room facilities. It is believed that there will be a large demand for machinery



which can be delivered from stock, and this will certainly be of decided advantage to purchasers who are reconstructing their plants.

Chas. C. Moore & Co. are agents for the well-known Babcock & Wilcox water tube, stationary, and marine patent safety boilers, manufactured by the Babcock & Wilcox Co. of New York; the McIntosh & Seymour steam engines, built by the McIntosh & Seymour Co. of Auburn, N. Y.; Ideal self-oiling steam engines, built by the Ideal Engine Co., of Springfield, Ill.; Hamilton-Corliss steam engines; Harrisburg double and four-valve steam engines; New York safety steam engines; Snow steam pumps; Dean triplex power pumps; Wheeler condenser apparatus; Edwards air pumps; Chapman valves; Lagonda tube cleaners; mining machinery of all kinds and steam power plant auxiliaries, such as Stratton steam separators, Goubert feed water heaters, Hoppes purifiers, Monarch engine stops, induced draft apparatus, Green's fuel economizers, and other similar appliances.

There are being constructed by this firm at the present time the following complete installations: A 15,000-kilowatt steam-driven electric power plant at Redondo, Cal., for the Pacific Light and Power Co., of Los Angeles; steam boiler plant for the Helena Power and Transmission Co., at Helena, Mont.; complete steam pump irrigation plant for T. J. Fields, at Soledad; the isolated electric light plant for the Perkins Building, in Tacoma; boilers and engines for the electric light plant of the Fairmont Hotel; a similar plant for the Hotel Del Monte, and other smaller installations. They also have under construction by the Mining Department a 100-stamp mill for the Tonopah Mining Co., of Nevada, and a 60-stamp mill for the Tonopah-Belmont Development Co.

The other offices of this firm are at Los Angeles, Cal., Seattle, Wash., Salt Lake City, Utah and New York City. Notwithstanding the effects of the fire, their San Francisco, or main, office is still the center of activity of this progressive engineering firm.

DEAN ELECTRIC CO.'S KANSAS CITY OFFICES

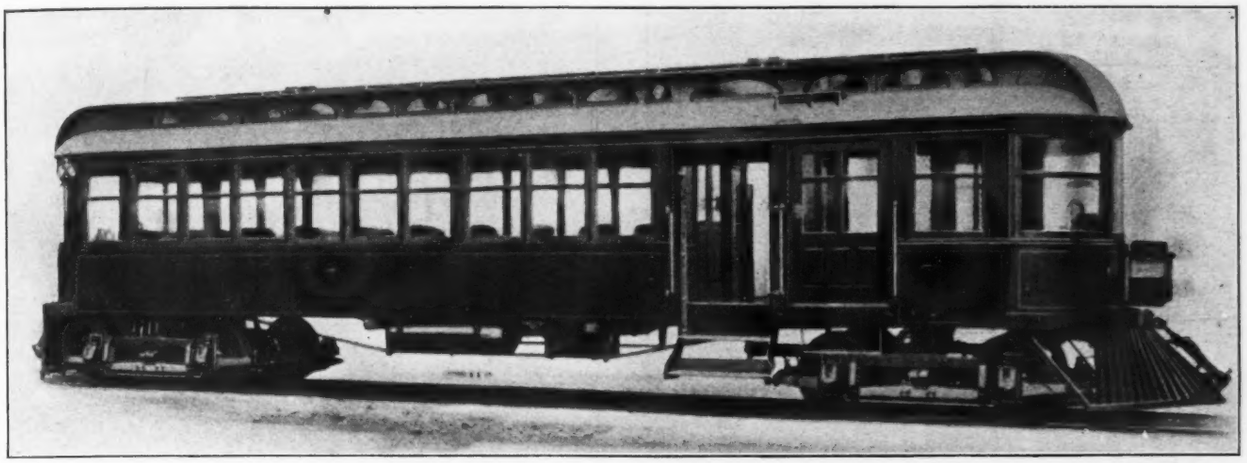
The Kansas City branch of the Dean Electric Co. has received such an increase in business that it has become necessary to move to larger quarters. They will occupy the entire ground floor of the Waterworks building, corner Sixth and Walnut streets.

They will carry the largest stock of telephone equipment west of the Mississippi river, and will be in a position to ship the same day orders are received.

Mr. L. G. Bowman, who has had a wide experience in the manufacture and sale of telephone apparatus, has charge of the Kansas City branch office as western manager.

Messrs. Pierson, Roeding & Co., 409-415 Monadnock building, San Francisco, have recently been appointed the exclusive Pacific Coast selling agents for the J. G. Brill Co. of Philadelphia, Pa., and its constituent plants, the American Car Co. of St. Louis, Mo., the Kuhlman Car Co. of Cleveland, Ohio, and the John Stevenson Co. of Elizabeth, N. J., manufacturers of city, suburban and interurban electric cars and trucks.

They have associated with them as manager of the car and truck department Mr. A. N. Hargrove, who has been with the Brill Company for several years as one of their head salesmen and car experts.



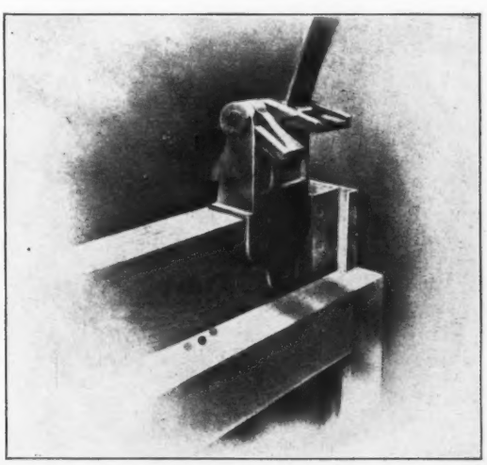
Center-Vestibule Interurban Semi-Convertible Car, for Petaluma and Santa Rosa Railway Co. Length over end sheathing, 46 feet 1 inch. Brill No. 27-E-2 Trucks.

MODERN ELECTRIC RAILWAY EQUIPMENT.

The J. G. Brill Companies are the exclusive builders of the grooveless post semi-convertible car, and the tremendous success of this type of car is due to the fact that it contains all the essential features demanded of the most advanced form of city and interurban service. It is not only a car equally suitable for summer and winter service, but is the most convenient and economical car to handle on account of its having maximum interior width and therefore a wide aisle, and also because of the easy operation of the windows. Incidentally the windows are protected from breakage while in the pockets. With one easy lift the sashes are safe in the pockets or may be held at any desired height by the window lock stops.

Dropping the sash into a wall pocket means two or more operations. Most passengers let the sash slam down into the pocket, which is safer for their hands than for the sash. The side roof is the logical place for the window pocket. Dropping sashes into pockets in the side walls has several serious objections. The framing for the pockets takes up space which cannot be spared in cross-seat cars, reducing the interior width from 6 to 7½ inches.

Maximum interior width is obtained, the window sills may be as low as desired, and no unsanitary recess or pocket is formed. The general plan of the window system consists of a pair of sashes, the lower one attached to the upper by a sliding connection, and both conducted into a roof pocket by means of a pair of bow-shaped steel guides. Both upper and lower sashes have brass stiles. The stiles of the lower sash have grooves in which slide tongues extending from the stiles of the upper sash. The tongues are composed of spring brass inclined outwardly from bottom to top so that the lower sash in being raised is moved slightly away from the surface of the upper sash to prevent friction. When the lower sash is raised the top of its frame comes in contact with triggers in the roller brackets which are secured to the top of the upper sash. The triggers operate catches which spring into metal strips in the letter panel when the upper sash is drawn down, to prevent dislodgement. After the lower sash presses the trigger up, it contacts with the extension or toes, also on the roller brackets, and by them the upper sash is raised.



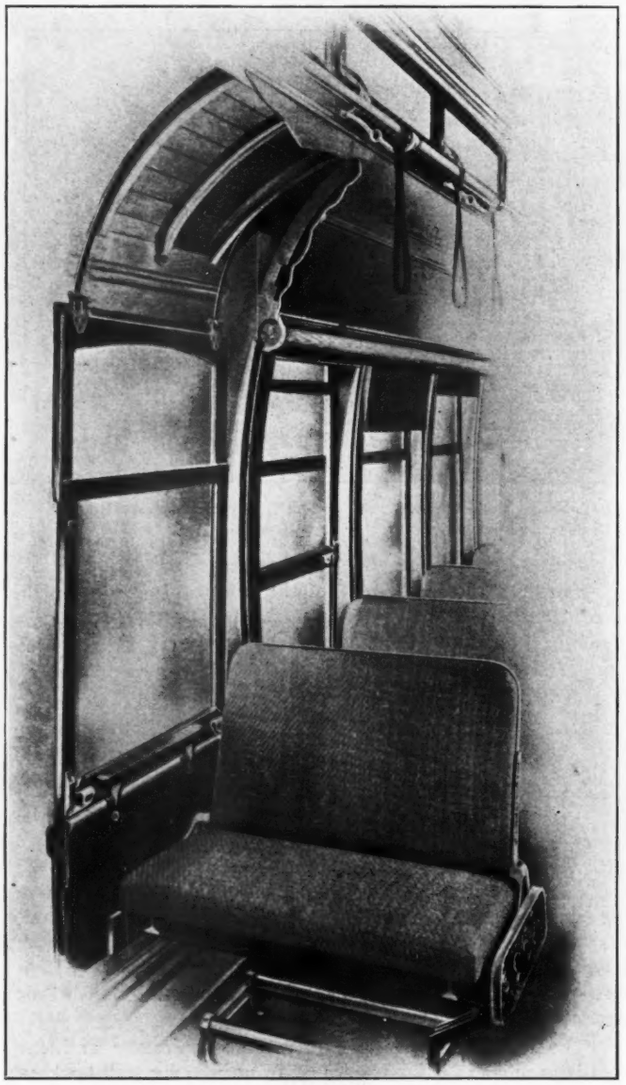
Front View of Roller Bracket with Automatic Spring Catch. Tongue and Groove Sliding Connection of Sashes.

The low window sill is an important feature and one that is peculiar to this car because of not having wall pockets.

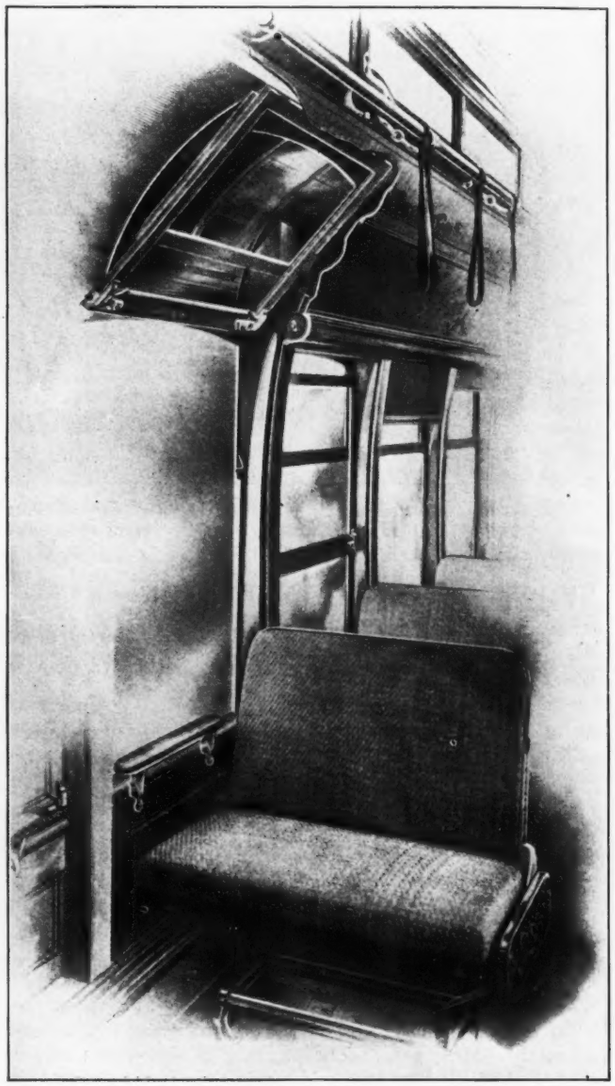
Finally, wherever a transverse seating arrangement is required and side entrance with running board must be avoided, the Brill grooveless post semi-convertible car will be found to embody every essential feature to highest efficiency. In the wide field of service which it is suited there has not arisen a single condition which it does not anticipate. The semi-convertible type is the adoption of the closed car to modern service, and the grooveless post semi-convertible is the type brought to perfection, and is most suitably adapted for the Pacific Coast climatic conditions.

The J. G. Brill Company were the first to recognize the correctness of the principle of the solid forged side frame trucks for electric railway service, and its early adoption and subsequent universal practical operation has proved conclusively the correctness of the principle. The rapid increase of weight and speed in the first years of electric traction made the inherent defects of the composite frame so apparent that were it not for the great difficulties which attend the introduction of the solid forge process, the composite frame would have been obsolete long ago.

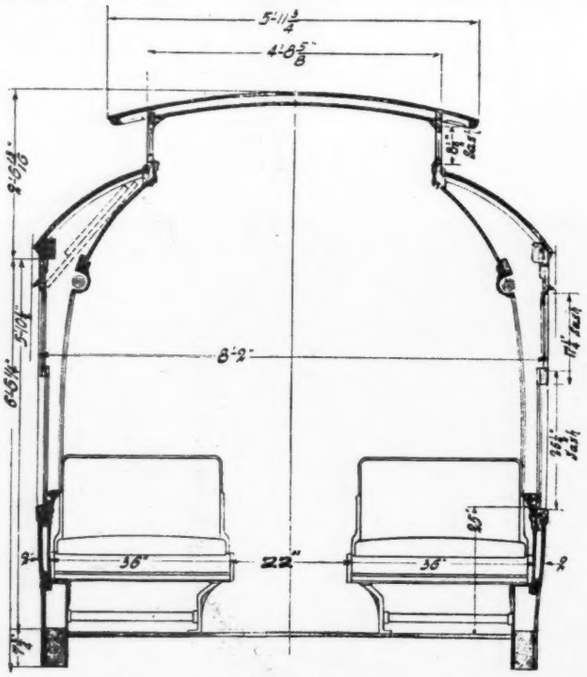
The history of the electric truck frame is remarkably parallel with that of the locomotive frame, the conditions are even more severe, for in addition of the truck being a locomotive, it must carry the car. Frequent crossings, short curves and the incessant use of the brakes make greater demands upon the stiffness and strength of the frames. The controlling idea in the early construction of the track frames was the same limited conception which predominated in the infancy of locomotive frames—to obtain maximum power



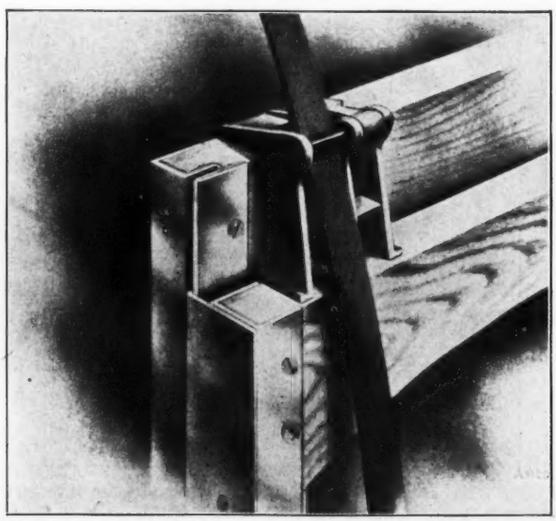
The Lower Sash is attached to the Upper by metal tongue and groove sliding connections. Rollers in brackets at top of Upper Sash move upon bow-shaped steel guides and conduct the sashes into the roof pocket.



Powerful Locks of special form hold the sashes in the roof pocket with absolute security. Note that the posts have no grooves.

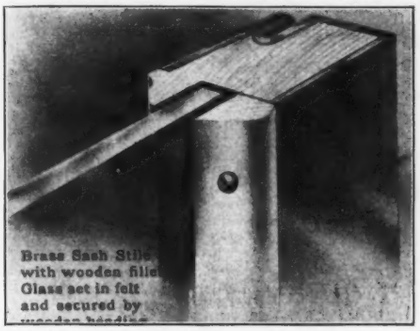


Cross section of Semi-convertible Car with transverse seats. Note extra interior width gained by not having window pockets in the sides.



Back view of Roller Bracket. Automatic spring catch retracted, showing tongue and groove sliding connection of sashes.

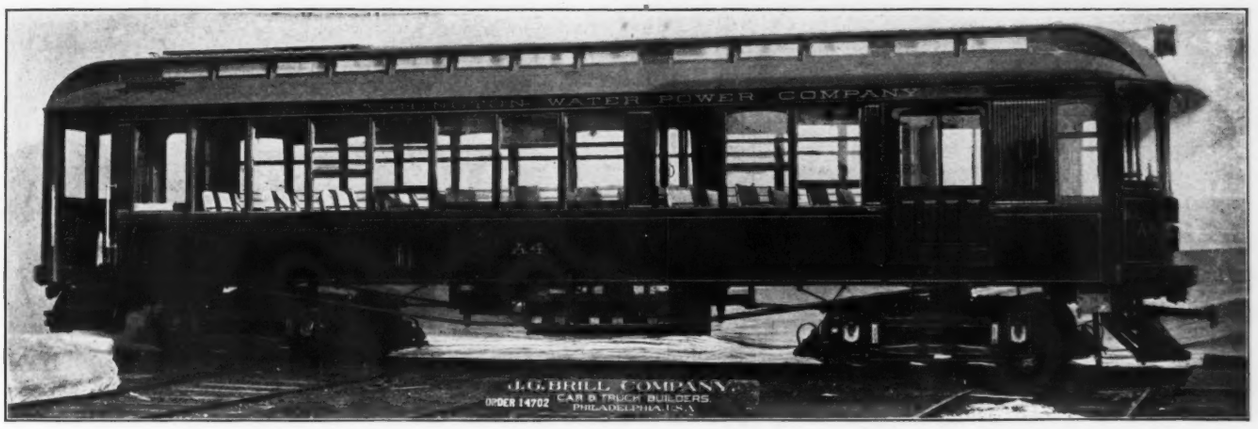
from the most available sources. It requires little mechanical knowledge to understand that it is a simple matter to construct a built-up frame in comparison to one which is a solid forging. The great expense in installing and experimenting with the heavy special machinery required has discouraged manufacturers in attempting it. During several years' experience with composite frames it became more and more apparent that the principle of the solid forged frame of the steam locomotive was not only applicable, but essential. In the composite frame no rivets had been used where bolts could be substituted, and the composition was the most scientific possible, but the result was, and always will be, the same. In a short time the heavy and continual pounding stretched and loosened the rivets; the general lack of stiffness soon permitted the driving mechanism to get out of alignment; repairs were continually needed, and the trucks were short-lived.



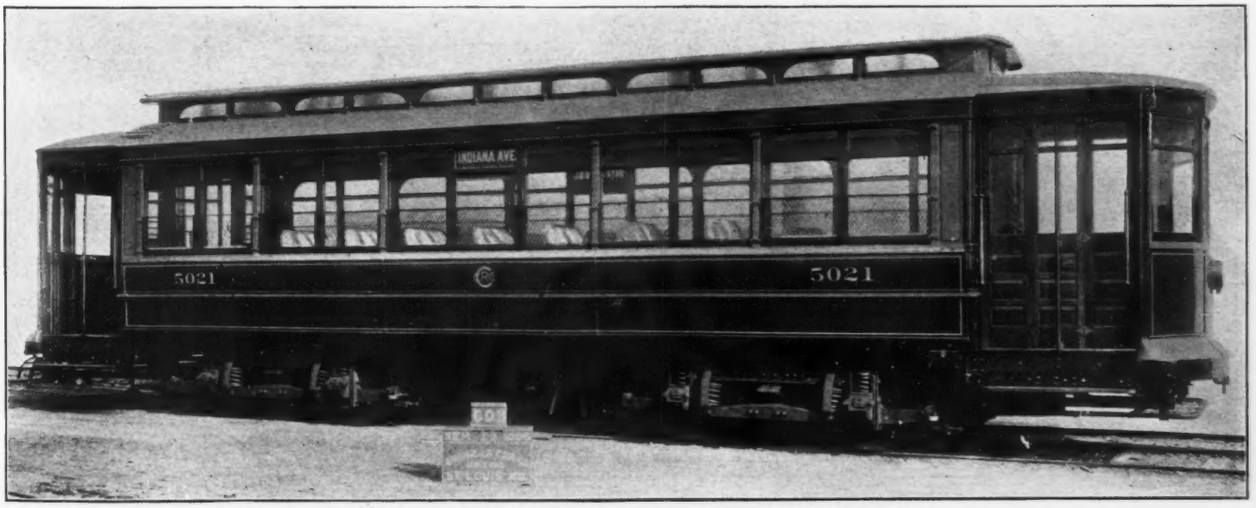
Brass Sash Stile with wooden filler. Glass set in felt and secured by wooden beading.

Solid forged frames were first made for the single type of truck in 1890, and the complete success encouraged the continuance of experiment upon the application of the process to the more complicated form of the double truck. The mechanical difficulties which for years seemed well nigh insurmountable were at length entirely overcome, so that for years all types of Brill trucks have been built with solid forged frames.

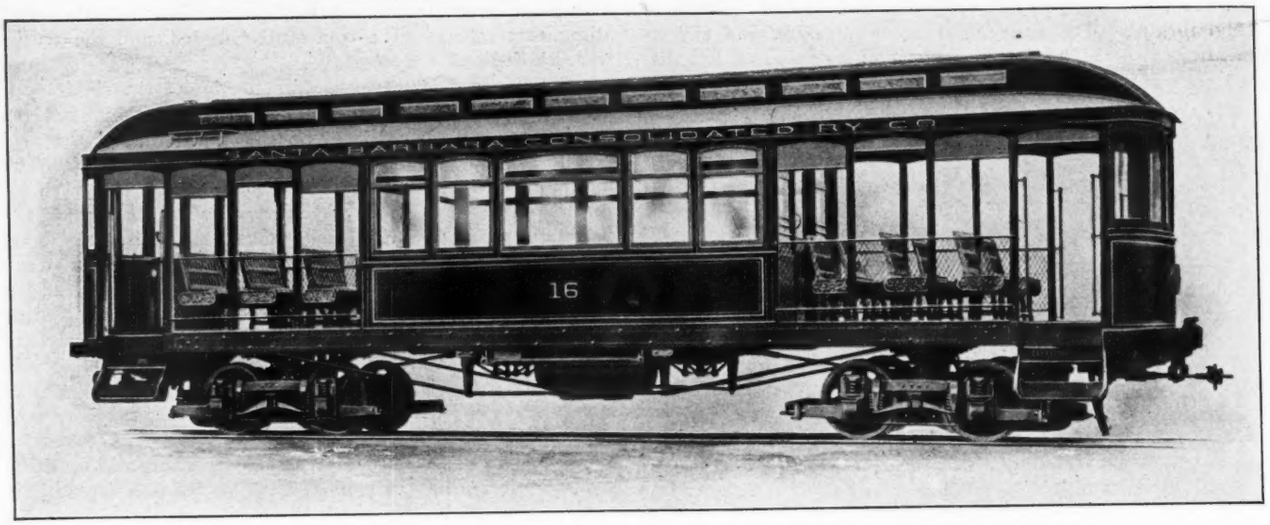
The 21E truck has two features which place the truck in a class by itself—they are solid forged side frame and diagonal braces. The spring arrangement provides for carrying the car body two inches lower than any other single truck. This is a large advantage, as single trucks are chiefly used in city service, where the matter of two inches in height of steps makes an important difference in the time taken by passengers in getting in and out of cars. The position of the semi-elliptic springs extends the spring base as far as it is necessary to obtain an easy and steady support. The eight coil springs are placed close to the yokes and nearly over the coil springs in the journal box cars which support the side frames. The wonderful wearing qualities of the truck are chiefly due to the fact that the solid forge side frames, with their diagonal cross braces, are able to keep square and hold each part in the exact position in which it is first adjusted.



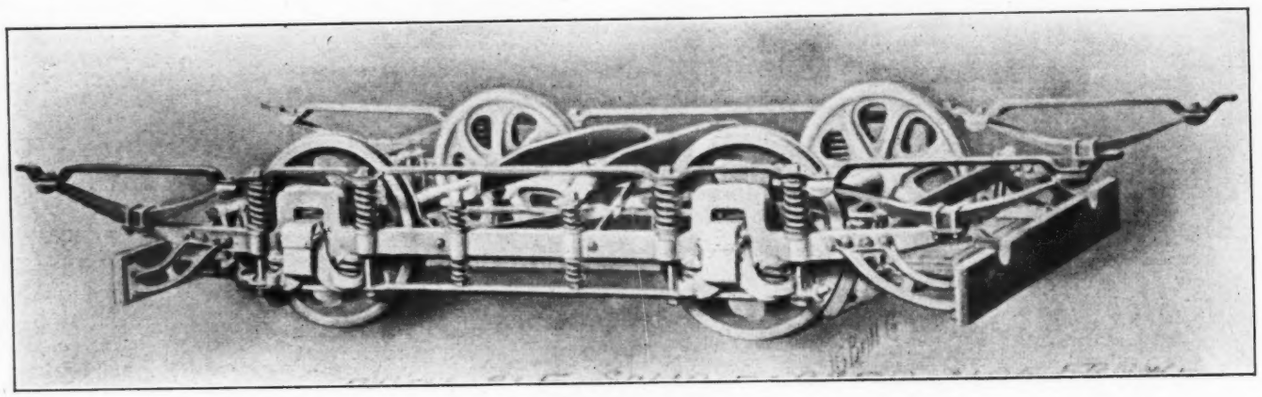
Brill Grooveless Post Semi-Convertible Car for Washington Water Power Company. Length of body, 41 feet 6 inches. Mounted on Brill No. 27-E1½ Trucks.



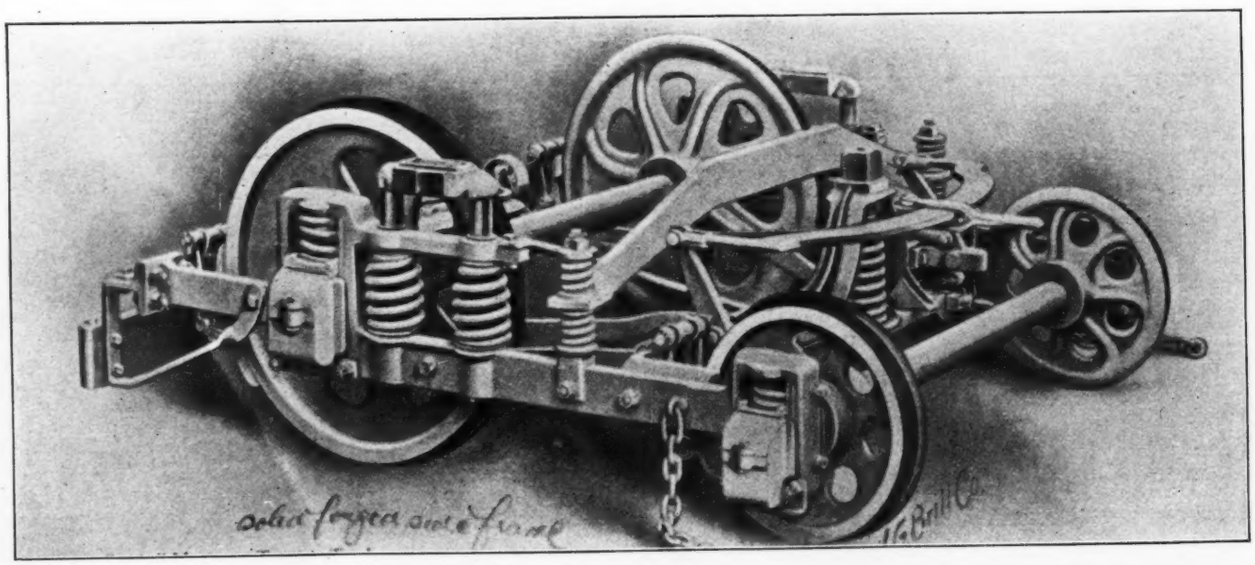
The above car illustrates one of the fifty recently built for the United Railroads of San Francisco by the American Car Company.



Double truck type of "California" Car, built for the Santa Barbara Consolidated Railway Co.



Brill 21-E solid forged side frame truck.



"Eureka" Maximum Traction solid forged side frame truck.

For complete filling of all requirements of city service and for economical operation the "Eureka" maximum traction truck holds the first place. The truck carries the car body as low as the single truck and works perfectly in cramped quarters between the sills of narrow cars. It radiates from a point only 6 inches inside the driving axles, which reduces the swing of the driving wheels to a minimum. The pony wheels do not interfere with the running boards of open cars on curves of the shortest radii. With three-quarters of the load on the drivers the truck accelerates rapidly and climbs grades easily. The brake system includes differential levers, which proportion the amount of pressure on the wheels according to the load which they carry.

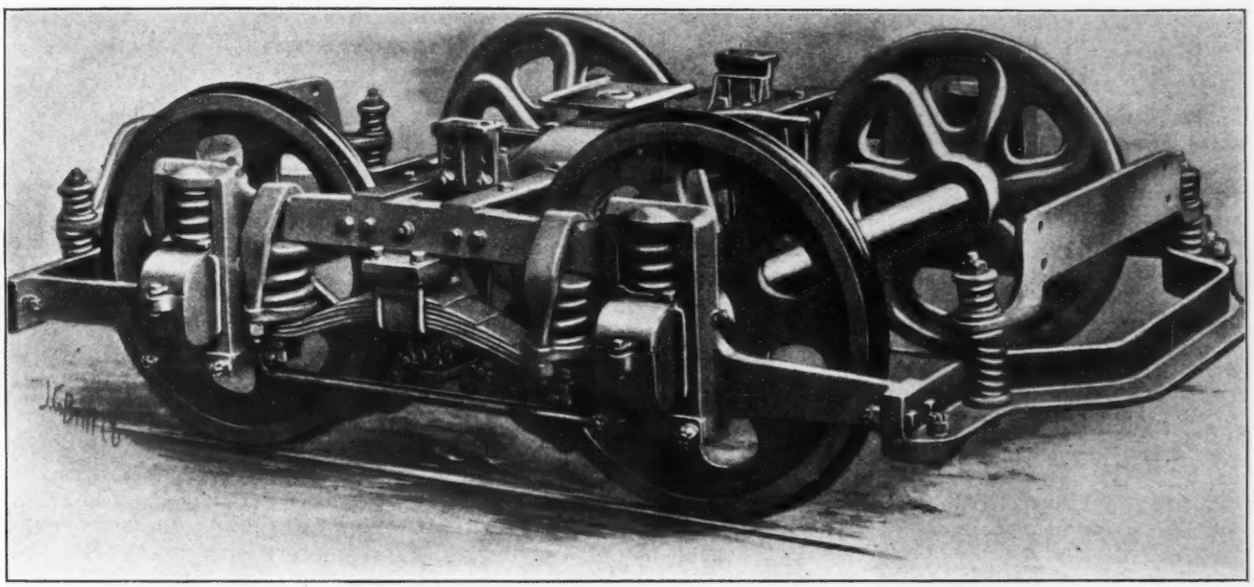
For heavy city and suburban service the 27G has the advantage over other short wheel base double trucks of being equalized and having a cushioned side swing. The sets of springs, working in series, comprise the spring system, cushioning every motion, and the solid forged side frames are capable of maintaining squareness. The wide suspension of the load upon the frames gives a leverage in favor of stability, essential with outside hung motors. The fact that the brakes require very little adjustment is proof of frame stability.

The 27E type of high speed truck also has the Brill system of equalization, which accounts for its never having been derailed except in collisions. Besides its marvelous tenacity with which it sticks to the rails under all conditions, it is the easiest riding truck for heavy cars, and is capable of practically unlimited speed.

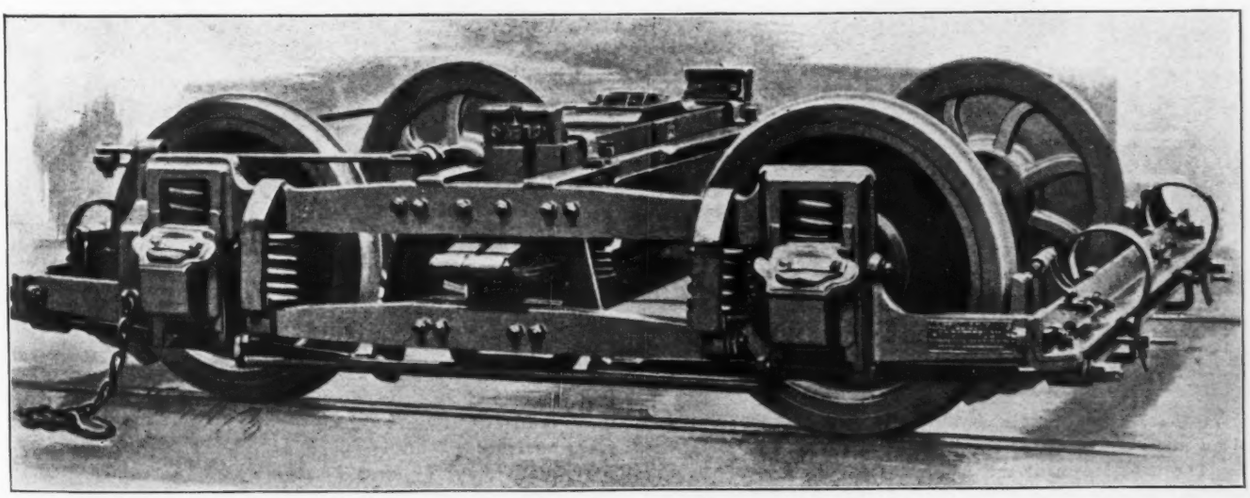
The Brill trucks of the "Master Car Builders" type are designed in accordance with the principle established by the broadest experience in the construction and operation of this form of truck.

Various requirements are considered and such modifications made as are necessary to adapt the truck in every respect to the conditions of service necessary.

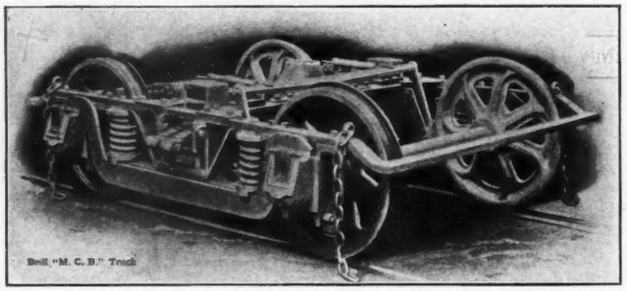
The cars and trucks illustrated are characteristic of the output of J. G. Brill Companies plants, and during a long period of successful building they have furnished steam road and street railway rolling stock of every description, and since the introduction of electric traction have confined themselves chiefly to that class of equipment. Having acquired a leading place by the production of successful types and high quality of workmanship, they have continued to hold that place through years of marvelous development of electric transportation and corresponding advance in car build-



No. 27-GE-1 Truck. Solid forged side frames.



No. 27-E Truck. Solid forged side frame.



Brill "M. C. B." Type of Truck.

ing. The types of cars and trucks are developed to a completeness that comprehends every traffic condition and convincingly illustrate the scope of their appreciation of the needs of the various fields of service. They have the proper facilities for constructing in accordance with any design.

Within the last year the Brill Company added to their magnificently equipped plant in Philadelphia a department for the manufacture of car seats and woven rattan, with every modern facility for economical and first-class production.

They have also just completed a modern brass foundry for the manufacture of every description of bronze trimmings.

THE FLAME ARC LAMP.

The Stanley-G. I. Electric Mfg. Co. have recently placed on the market a flame arc lamp known as the Stanley-G. I. "Brilliant." These lamps are made for either alternating current or direct current circuits, both types being of the converging carbon construction, i. e., both carbons feed downward toward each other so as to focus the arc at the same

point, thereby eliminating shadows and preventing the formation of non-conducting slag at the carbon tips.

The mechanism of the direct current lamp is of the differential magnet type, while that of the alternating current lamp is of the differential disc motor type, the carbons in both cases being regulated by chain feed. Both types are designed, adjusted and carried in stock to burn two in series on 110-volt circuits, standard resistance being furnished with the direct current and a reactance coil with the alternating current lamps. All lamps are adjusted for 12 amperes and an arc voltage of 45. Both golden yellow and white light carbons can be used on the direct current lamps, but golden yellow only will be furnished for the alternating current lamps.

The weatherproof steel casings, finished in bright japan, are the same for either lamp and are interchangeable. The feeding mechanism is contained in a separate compartment of the case, so carefully partitioned off from the arc that it is unaffected by the heat or loose slag.

PORTABLE DESK TELEPHONES.

The Dean Electric Co. of Elyria, Ohio, have recently issued a very complete treatise in the form of a bulletin on their portable desk telephones.

As portable desk telephones have always been a favorite type with the subscribers, but due to the weak and complicated parts, have made it unsatisfactory for the telephone company to maintain. This fact was taken into consideration

Fig 1—A Dean Portable Desk Telephone.

in the designing of the Dean set, besides giving it an exceptionally neat appearance, which is illustrated herewith. (Fig. 1.)

The thoroughness of construction, ease of operation and accessibility of parts are features which are placing these instruments in a class by themselves.

The inner framework of these stands is formed from heavy seamless steel, making them non-breakable and of the most rigid construction. (Fig. 2.) The hook lever is made from one piece of heavy sheet brass and is formed by being drawn into shape by several operations. Thus when finished they give the appearance of a solid piece and of unlimited strength. (Fig. 3.)

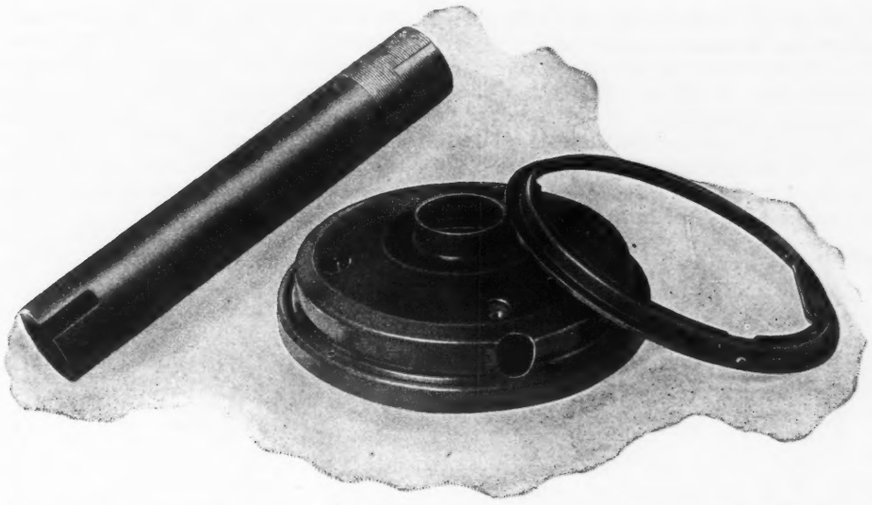


Fig. 2—Heavy Seamless Steel Parts Forming the Inner Frame Work of the Desk Stand.

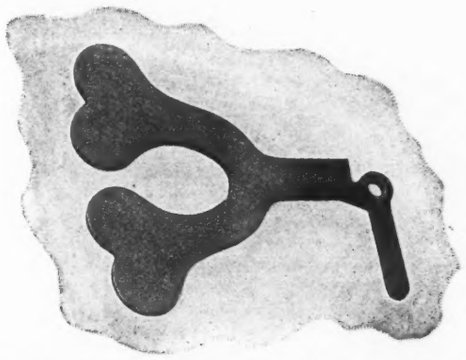


Fig. 3—The Heavy Sheet Brass Blank from which the Dean One-Piece Hook Lever is made.

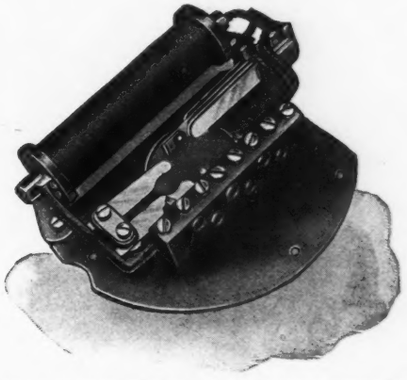


Fig. 4—A Dean Interchangeable Local Battery Desk Stand Circuit Plate.

The interchangeable circuit plate used in these stands is an entirely new and original Dean feature and which makes the instrument of double value. (Fig. 4.)

All of the talking circuit apparatus, excepting the transmitter and receiver, are mounted on this metal plate and completely wired so as to form a unit. Thus an exchange operating a local battery system and using the Dean desk stands and wishing to change to a common battery system, it is only necessary to change the circuit plate for the desired circuit. Soldering irons or special tools are not necessary for making this change, as the plates are complete within themselves.

The simplicity in removing the parts for inspection is illustrated in Figs. 5, 6 and 7, which are also distinguishing features.

Fig. 5 shows the method of removing the base cover, which is securely held in place by a lock which is readily operated by a screw driver, turning to the left to open and to

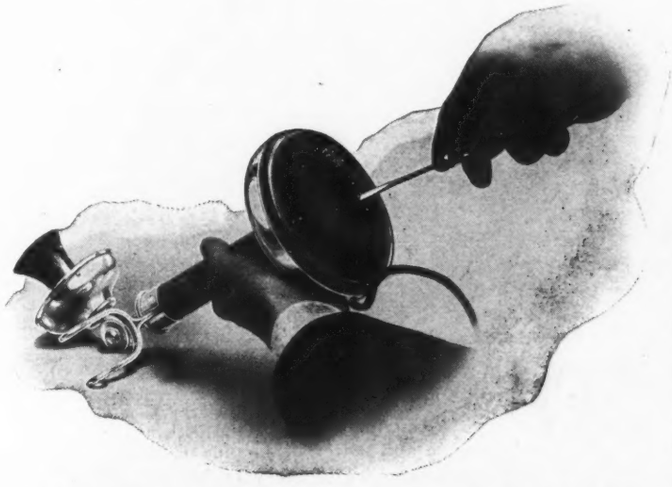


Fig. 5—Method of Releasing Lock to Remove the Base Cover of the Dean Desk Stand.

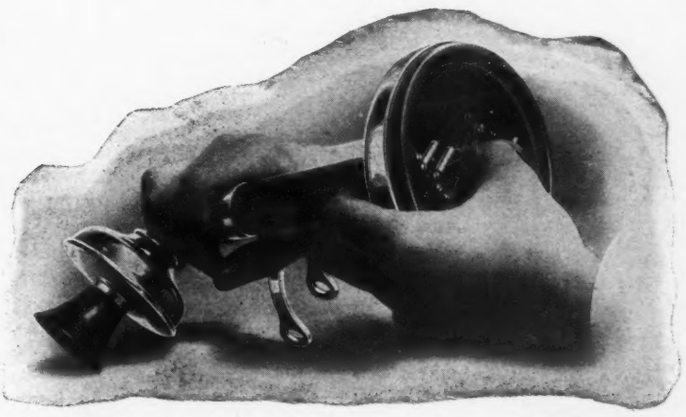


Fig. 6—Withdrawing the Hook Lever Mechanism from the Upright Tube after Releasing the Hook Spring and the Base of the Dean Desk Stand.

the right to close. No special tools are necessary for doing this operation, neither are there any screws or small parts with their liability of being lost. When this cover is removed all of the circuit parts as well as the contacts of the hook switch are completely exposed.

Fig. 6 illustrates the simple method of removing the hook lever mechanism from the upright tube by releasing the lock spring by the pressure of the thumb. This allows the parts to be removed for inspection, as described in Fig. 7.

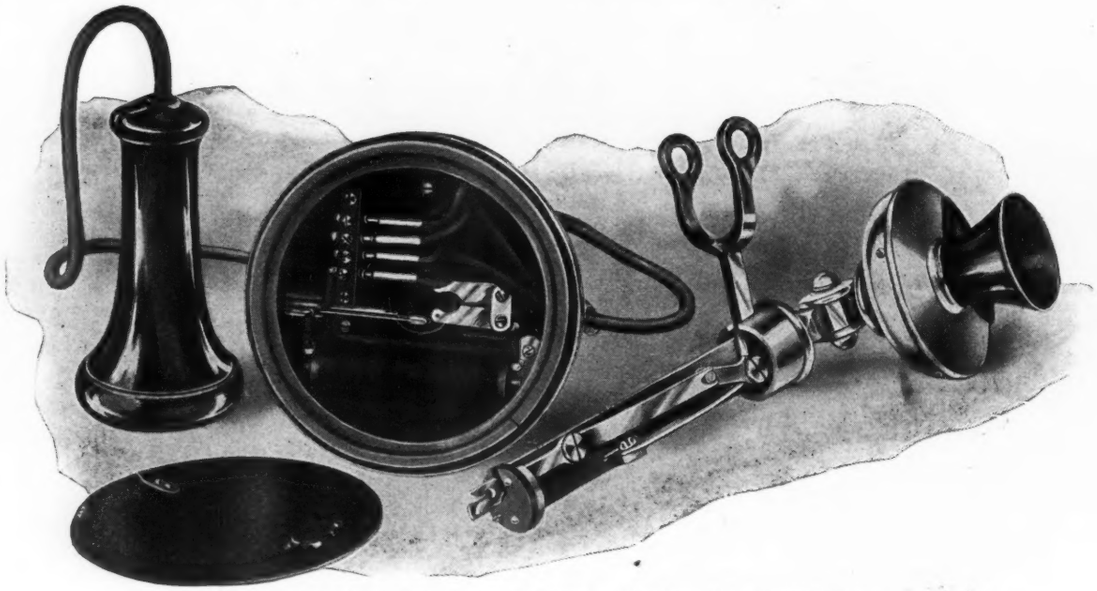


Fig. 7—A Dean Desk Stand with Parts Removed, Showing the Accessibility of the Parts.

A leather cushion ring placed on the bottom of the desk stand to prevent marring of desk or other furniture on which it may be operated remains in place after the base cover is removed, thereby completely serving its purpose. It takes but a few seconds to completely open the stand, as illustrated, and to assemble it again.

The Dean Electric Co. states that to those who have not received a copy of this bulletin No. 103-F can secure same for the asking.

"VICTOR" COMBINATION METER.

The "Victor" is the only electrical meter giving a simultaneous reading of volts, amperes, watts and horsepower on one dial. It is practically two separate and complete instruments combined in one case, each of which act independently of the other, as far as the volt and ampere readings are concerned. The readings in watts and horsepower are obtained from the point of intersection of the two indicators.

As a watt meter this instrument is accurate at any voltage within the limits of the volt scale, which is not true of other watt meters which are only accurate at a pre-determined voltage. The watt scale is laid out from actual calibrations with a reliable standard, insuring absolute accuracy in the result. The horsepower scale is then obtained mathematically from the watt scale.

The "Victor" has a wide range of uses which will suggest themselves to the practical engineer. It is the only practical switchboard instrument giving a reading in watts and horsepower. While combining four instruments in one, it requires only the space of a single instrument, thus adapting it to the smallest switchboard panels.

In large manufacturing plants an instrument of this kind will indicate the amount of horsepower chargeable to separate departments or to single units in same, thus filling a requirement hitherto unsatisfied. The safe working load limit of electrically driven planers, milling machines, lathes, shapers, etc., can be obtained at a glance. May be used as a check on work in a tool. When once the safe load limit is known, the maximum output can be secured by keeping as near to the proper point of intersection of the vertical dial as possible. In mills using electrically driven squeeze rolls, the pressure between the rolls can be accurately gauged by noting the horsepower reading, and conditions may be duplicated indefinitely.

Applied to electric elevator cars, the operator can properly weigh each load. When the load limit has been ascertained, any overload can be instantly detected, and the excess weight, whether passengers or freight, should be removed.

Traction and brake effects of electrically hauled trains can be ascertained instantly in a way that is positive, and thus promote the conservation of power and increase the life of the equipment.

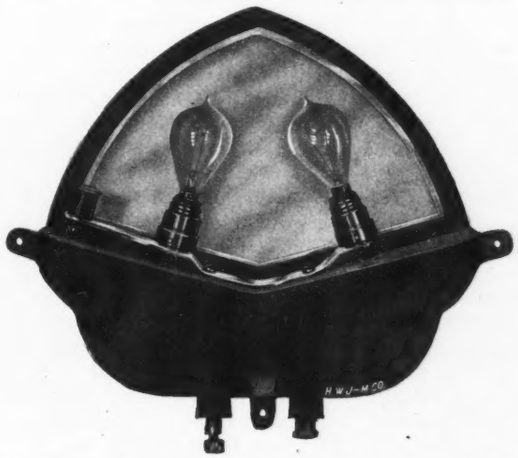
To builders of engines, direct connected generators, electrically driven printing presses and hundreds of other ma-

chines, the facilities afforded by the "Victor" for electrically testing horsepower afford a distinct advantage over the pony brake in first cost, maintenance, reliability and scope.

The workmanship and materials employed in the manufacture of this instrument are of the very highest order, insuring absolute accuracy and great durability. While light in weight, it is very rigid and not at all delicate, and will

withstand vibrations of considerable violence without its accuracy being impaired in any way. It requires a minimum of energy to operate it, making it extremely sensitive, and it is also free from magnetic lag, unaffected by temperature variations, dead beat, and can safely remain continuously in circuit.

All "Victor" instruments are illuminated from the rear (see Fig. 2), thus saving space on the smallest panels.



The "Victor" meter is being placed on the market by the H. W. Johns-Manville Co. of New York, with branches in all large cities.

TELEPHONE ENGINEERING.

Mr. C. E. Scribner has recently contributed an article to the "Sibley Journal of Engineering" on the advantages of telephone engineering as a profession.

As chief engineer of the Western Electric Co., which is the largest manufacturer of telephone apparatus in the world, he is well qualified to write on this subject, and the points brought out are worthy the consideration of every reader of the "Journal." They are of interest not only from the engineering standpoint, but also on account of the great development of the telephone industry as shown in the following abstract of the paper:

The public know perfectly well the simple operations necessary to obtain communication with any desired person; operations so few and simple that they give the casual user no hint of the vast and complicated mechanism set in motion. To remove the receiver from the hook and to give central the number desired requires no great degree of intelligence. That done, the public's part is accomplished and in a few seconds, without further action of the caller, the person desired is obtained. Undoubtedly this is simplicity itself.

If this lack of information of the workings of the telephone was confined to the public it would be of no great matter, but this is by no means so. A man of wide experience as a street railway engineer was once told by a young college graduate that the telephone field seemed to promise greater advancement. "Well," he replied, "if you want to go in for that sort of thing all well and good, but if I were you I would stick to straight engineering." In that reply the railway engineer summed up the attitude of a great number of young college graduates and of men yet in college. Stripped of all unnecessary words and phrases their position is simply this, that the telephone field while affording ample scope for the electrician and mechanic, offers no opportunities for the engineer. For them an instrument screwed to the wall, at one end, connecting with an operator furnished with some plugs and spring jacks at the other makes a telephone system. Such a view is absolutely misleading, for while it is true that the telephone engineer does not handle immense loads nor send power at high voltages over long distances of line, still he comes into very intimate, although indirect, contact with both these phases of engineering. If he is to be a successful telephone engineer he must have more than a fair working knowledge of the conditions and laws governing these classes of work, and if he does not occupy the center of the engineering stage there is no doubt but every day brings a more general realization of the great number and varied scopes of the problems he must meet. These problems are not questions of adaptation to local needs, although there are an infinite number of such problems, but concern the field of universal application.

The point that emphasizes itself to the man working along the power and light lines is that the telephone engineer seems to confine himself to one piece of apparatus and to connecting it up in numerous and complicated ways by all sorts of ingenious devices. It seems to him that while all this may be very pretty and interesting it does not afford enough scope for a man to display his real talents. Such an opinion can certainly come only from a very superficial survey of the situation. The telephone engineer does not confine himself to the telephone and its connections except in the very broadest sense, and while it is true that the telephone instrument and its connections are the primary object and ultimate end of all telephone engineering, every branch of the profession is called upon to contribute its aid in accomplishing the desired result. For instance, the power plant of a large telephone central station is in every respect as complete as any power or lighting plant in its details. Direct-current dynamos, generally in the form of motor-generators in large cities, supply current to a complete storage battery which in turn drives numerous alternators. In a large telephone switchboard as many as 15,000 incandescent lamps are used for signaling purposes. Surely this is as many as are supplied by some lighting plants. So it is evident that the telephone engineer must also be a good power man.

When we come to the field of the distribution of energy any comparison is distinctly in favor of the telephone engineer. Take, for example, an electric light plant and compare it for a moment with the water system of the same town; they are remarkably similar in many details. Both draw their supply from some central source. In both the method of distribution is by large mains along the principal streets from which the customers draw their supply. Turning on or off either current or water at any local station or by even a considerable number of local stations had no effect on the existing normal conditions except a slight increasing or diminishing of the load at the central station. Now consider the conditions which the telephone exchange of the same town must meet in its distribution of energy, for here the difference of refinement between power work and telephone work is most strikingly illustrated. Suppose the waterworks were obliged to transmit a certain quart of water from any designated house to any other house instantly on the request of the householder. Imagine the network of piping and the thousands of valves necessary, in even a small town, to perform such a requirement. Yet this is exactly the problem which confronts the telephone engineer. He must, at a moment's notice, be prepared to transmit a certain definite quantity of electricity from any subscriber to some other subscriber without interference or loss. Moreover, the problem is complicated by the fact that the telephone engineer not only must transmit this definite quantity of electricity, but that it must be of a certain quality. That is to say, the alternating current wave must be transmitted without any variation of shape or frequency. This wave is exceedingly complex in shape and character and it is readily seen that any variation in its transmission means a corresponding loss of efficiency in the transmission of speech. This fact enforces inflexible conditions upon the engineer which cannot be violated. Even disregarding this latter fact, there is as much difference in the planning of an electric light plant and a tele

phone plant as would exist between the ordinary system of water mains and any system devised for the transferring of definite quarts of water. While the one is comparatively simple, the other is the height of complexity. Perhaps the statement that in a telephone switchboard of 10,000 subscribers there are about one hundred million possible connections will give an idea of how complex the problem really is.

In the field of transmission as well as in the field of distribution the telephone engineer again faces conditions far more difficult than those which meet the power engineer. In power practice there is little or no call to arrange the plant with any regard to a system of interconnection. That is to say, while power is transmitted over long distances, it is almost invariably from one central station. In no case probably would a power plant of a large city be called upon to supply the customers of far distant cities with power, and it is doubtful, although perfectly practical, if a satisfactory method of adjusting such loads could easily be found. But the telephone engineer must provide means for inter-connecting all the telephones scattered over an area of territory many hundred miles in extent. That is to say, that taking any instrument as a center he must make it possible for its subscriber to communicate with any telephone within a given radius. This radius is now many hundred miles in length. One of the problems of the telephone engineer is the consideration of how to increase this effective talking radius; and yet the solving of the problem creates other problems no less important. For instance, every additional mile added to the practical distance of the transmission of speech multiplies to an unappreciated extent the number of available connections that can be made. Take for example Boston and St. Louis and figure the mathematical chance of any certain telephone in Boston requiring a connection to a certain instrument in St. Louis. It will at once be seen that this chance is very remote, yet the possibility of such a connection being required must be provided for, and the number of these connections grows with the rapidity of multiplication as the number of telephones reached from any single instrument increases.

A very interesting phase of telephone engineering is that of "development studies." These are carried on for every city, and a great mass of very interesting data has been accumulated. These development studies concern themselves with the growth of cities and towns not only in population, but in geographical extent and direction. In no other branch of the electrical field is it so necessary to plan for the future as in that of the telephone plant.

A large telephone switchboard takes from a year to two years or even more to build and install, and it is very essential that provision shall be made for all normal growth for years in advance. In fact, some of these studies are based upon the expected growth fifteen or twenty years hence. These plans are used primarily to determine the number and location of central offices and the arrangement of underground systems as regards the location and number of ducts. In some recent cases the cable plans have been made showing the cable equipment for the next five years. Such studies are of great value, as they count for economy in the construction of the plant.

There are many other problems which enter into the calculations of the telephone engineer besides those of distribution and transmission. Two of these are of much importance; the buildings for the central stations and the necessary protective devices. As long ago as 1880 the necessity of designing buildings suitable for installing central stations became very apparent. The dangers from fire, which would mean the interruption of communication over perhaps a large area, and the great difficulty in finding buildings suitable for the installation of switchboards practically forced the telephone companies to design adequate shelters for their switchboards. So it will be seen that the erection and design of buildings plays no small part in the duties of the telephone engineer.

To the matter of protection much attention has been given and the development of protective devices has been carried much farther than the average power man would imagine. Indeed, he has no call for any such refinement, but the telephone engineer must guard his delicate network of lines and apparatus from not only the destructive effect of lightning, but from any possible injury from his high voltage neighbors. Some of the protective devices manufactured will carry a current of .11 amperes for three hours and at the same time operate on a current of .16 amperes within 45 seconds. In other words, in order to meet the demands of the telephone companies, there must be made up by hundreds of thousands a protective device which will work within the limit of .05 amperes.

The Bell Companies have published some very interesting information on the growth of their business. In 1881 there was but one telephone for every 1,074 people in the United States, but by 1885 these figures had dropped to one telephone for every 418 people, showing how the general public appreciated the convenience and reliability of the instrument. Since 1885, in spite of the rapid advance in population, this rate has steadily been decreased until in 1904 there was actually one telephone for every 53 inhabitants. In the following table are given some of the more interesting statistics, and while they refer only to the Bell Companies, they show the steady and continued use of the telephone:

	1881.	1904.
Number of subscribers in the United States	47,880	1,525,167
Average daily number of messages	300,000	10,134,020
Number of communications per inhabitant, per year	2	42
Total miles of wire in use for telephone purposes in the United States	27,714	3,958,891
Miles of toll pole line in the United States	730	130,178
Miles of wire in underground telephone cable	0	1,618,691

Opportunities—Now what does all this lead to? It is certainly interesting to know that the telephone business is of such a size, but it would be more interesting to know what prospects of advancement it holds out for the young engineer in the future. The question arises, has not the telephone equipment been perfected and is not the switchboard at the height of its perfection? Has not the country been filled with lines uniting every small village with the larger towns and cities? Is not even the telephone a complete and finished instrument with small if any room for improvement? So although the telephone field in the past has afforded a magnificent scope for the activities of the engineer, does not the future resolve itself into replacing worn-out parts? To this and a thousand similar questions there is but one reply: there never have been better opportunities for young men in the telephone field than today. At no time during its history has its ratio of increase been greater, and this very growth constantly involves new problems. In fact, the public have no idea what an immense expense is entailed in the construction and installation of a large switchboard. In a board recently completed having an equipment of 5,600 lines and an ultimate capacity of 9,600 there was installed in the form of hand-made cables 5,960 pounds of wire. The total length of this wire if placed in a single strand would be 660,829 feet, or 125 miles. This amount does not include wire in the form of manufactured cables used in connecting up the switchboard. This amounted to 198,235 feet, or if as before, reduced to a single strand, 11,525,722 feet, or 2,183 miles. The total number of pieces of standard apparatus installed was 453,802 and the wire used in this connection was no less than 4,626 miles. The soldered connections in this switchboard amounted to 1,355,121. It is no wonder then that the problems of simplification and modification of the telephone switchboard command so large a share of the attention of the engineer.

Turning to the transmission field, why should a man not be able to speak from New York to San Francisco instead

of having to content himself with Omaha, and why should it be possible to talk half way across the continent on open wires stretched on poles when the limit through cables is some forty miles? Is it not possible to reduce the ratio which exists that one mile of cable equals 28 miles of open wire? These are only a few of the many problems awaiting solution, and the man who solves or partially solves them will reap a rich reward.

But it is not to these men alone that the telephone field offers an opportunity. The very magnitude of the business requires that the men employed shall be carefully trained and experts in their line. The cry of any great corporation or business is men, always more men of the right sort, and telephony is no exception to the rule. For the right men the telephone field offers certain and rapid advancement. Twenty-five years ago the business practically did not exist; today there are 70,000 people employed in the service in the United States alone, and there is no reason why the next twenty-five years should not only equal but exceed those past.

THE GROWTH OF THE TRADE PAPER.

The newspaper has a long history and although its development within the last 30 or 40 years has put the older efforts so far into the shade as to make them appear very puny, the followers of the "news letter" are essentially the same in principle as their progenitors. It is true the telegraph has supplanted the stage coach and the perfecting press the hand press of Benjamin Franklin's time, but the gathering of news and gossip of ephemeral character and its dissemination is still the function of a newspaper and will so continue to be. The oldest publication in the United States, originally a newspaper, is the Saturday Evening Post, founded in 1728 by Benjamin Franklin. Now it is a special publication filling a place between the newspaper and the magazine. It is rarely that a daily paper can present an article which reviews and summarizes a situation and points the trend of progress or draws a conclusion. A valuable feature of the publication referred to is that it presents articles which review conditions, marshals together related facts and gives the readers in a few words a grasp of a situation which they could scarcely ever get by reading newspaper. An article contained in the May 12-19 issues is on what the author is pleased to call a new profession, and that is editing and writing for trade papers. The trade paper, as we all know, is a comparatively new idea in journalism, strictly class papers being few that have an age greater than 25 or 30 years. But there are now hundreds of trade and class papers devoted to almost every trade and profession, some of which have a standing, capitalization and organization which rival that of small city newspapers. The writer of the article, Mr. James H. Collins, believes that the possibilities in trade journalism are considerable and that the business is one that affords many opportunities to the tarined writer who also has technical knowledge. He says in part:

"But while the trade journal has been developed phenomenally on its business side, its editorial growth has been less rapid. The newspaper and the magazine have certain literary traditions and heritages that have come to them through a long period of development. The trade journal has none. Each publication of this class, coming into a technical field that had never enjoyed a medium for the spread of information, was forced to make its own methods. And in the development of its editorial policy literary skill was usually unavailable. Engineering journals grew out of the prolix official report. Publications launched to keep a retail trade informed on prices, new goods and shop methods, were written by merchants and clerks. Contributions to journals dealing with machinery came from mechanics and foremen. One by one new trade fields were furnished with their especial journals, written from their especial viewpoint, in their own technical patois. To the newspaper and magazine writer these were Greek. But because the trade journals were written with yardstick and calipers, and illustrated with the blueprint, they had vitality. The exact information of engineers' reports, in which everything is stated with three synonymous adjectives, gave a basis upon which to build more direct articles. Journalistic and literary standards seem fatal to a trade periodical at the outset, but after the special field and patois have been defined by technical men, the trained general writer is often able to grasp them, shape a wider policy, vary subjects that trend toward set channels, and employ literary artifice not only in presenting matter more attractively, but in getting fuller, fresher information. For the technical half knowledge of a trained writer is often precisely the element needed to reveal and exploit points, which, in the technical man's judgment, seem commonplace.

"The number of trade journals in the United States is now estimated at between fifteen hundred and two thousand. About four hundred and fifty are published in New York City, which has fourteen daily newspapers devoted to finance and commerce; seventy weekly and monthly periodicals to finance, commerce, insurance and markets; seventy-five to iron, steel, manufacturing, mining, building, and wholesale trade; thirty-eight to railroads, electricity, engineering and machinery; sixty to law, medicine, pharmacy, architecture, science and education; fifty to literature, art, music, the drama, publishing and advertising; fifty to retail trade; forty-three to sports, fashions, agriculture, etc., and fifty of miscellaneous character."

A LARGE WATER WHEEL TURBINE.

An article was recently published by Arthur Giesler in the "Engineering News," describing the large 10,000 horsepower single wheel turbine at Snoqualmie Falls which represents an enlargement of the plant of the Seattle & Tacoma Power Co. to double its original capacity. The turbine in question has been running for some months and is the largest of its type ever built.

The 12,500 horsepower vertical turbines of the Electrical Development Co., the 10,000 horsepower horizontal turbines of the Ontario Power Co., and the 10,000 horsepower vertical turbines of the Canadian Niagara Power Co., all of which are at Niagara Falls, Ont., are duplex machines, as each unit has two runners on a single shaft driving a single generator. The Snoqualmie Falls turbine, with but one wheel, therefore represents by far the largest concentration of power yet accomplished in turbine water wheels.

The plant utilizes the power of the great falls of the Snoqualmie river, a mountain stream flowing down the western slope of the Cascade mountains, and transmits electric current to Seattle (25 miles west on an air line) and Tocoma (35 miles southwest). It was built in 1898 and 1899, and delivered its first current for commercial service in the middle of the latter year. The fall is about 270 feet high, and gives an available power, at minimum flow, of 30,000 horsepower, though by means of storage upstream the available power can be increased to several times this figure. The initial installation of machinery was of 10,000 horsepower capacity, but the head-bay and the tailrace tunnel were built for 20,000 horsepower, the plan being to extend the power house and put in additional machinery to raise the capacity to this figure as soon as the demand for more power was in sight.

The Snoqualmie Falls power plant is unique among hydraulic power developments. It employs neither the common arrangement wherein the power house is located on the river bank below the falls, nor the wheelpit construction as used in four plants at Niagara Falls, but an arrangement intermediate between the two. The great cost of the wheelpit made it inadmissible, and on the other hand the heavy spray and mist below the falls threatened to interfere with the proper operation of electrical machinery if the power house were located on the river bank. For these reasons the

machinery is placed in an underground chamber excavated in the solid basalt rock, some 250 feet below the surface. This chamber forms the power house. Its dimensions are, roughly, 200 feet by 40 feet, by 30 feet height; its longer axis is parallel to the river, and the lower end is about 300 feet upstream from the crest of the falls. From its downstream end a tailrace tunnel leads to the lower reach of the river. At the upper end of the chamber a vertical shaft, 10x27 feet in section, rises to the surface; the middle of this shaft is occupied by an elevator, and the end compartments contain the two 7½ feet penstocks.

Every part of the plant except the power chamber and the machinery was built for the full development. To extend the installation of machinery, when a demand for the second 10,000 horsepower would be in sight, it was planned to excavate a second chamber equal to the first, and on the same axis, extending upstream from the shaft.

Before the turbine was installed, the main power equipment of the station comprised four 1,500 kilowatt units, each composed of a six-wheel Doble tangential water wheel of 2,500 horsepower capacity and a 1,500 kilowatt Westinghouse three-phase alternator. These units run at a speed of 300 revolutions per minute and produce 60-cycle current at 1,000 volts pressure, which is raised to 30,000—33,000 volts for transmission. The water wheel units were arranged with two housings each, three 45-inch wheels in a housing, and two 3⅞-inch nozzles per wheel.

About two years ago it became evident that increased generating capacity would soon be required. A small amount of space at the end of the existing power chamber was available, not enough, however, to accommodate much power if the old type and size of units were employed. It appeared that by using a turbine unit of large capacity this space would suffice, without additional excavation, for a unit developing a large part of the capacity of the second penstock. On detailed inquiry, including proposals and bids from the leading water wheel builders in this country and abroad, it was found that a single wheel turbine could be obtained within the limits of the available space that would develop the full 10,000 horsepower. It was designed for an effective head of 260 feet and a speed of 300 revolutions per minute, the latter fixed by the limitations of generator design. While slow-speed generators of the capacity of the proposed unit were in existence, and smaller generators running at speeds equal to or higher than 300 revolutions per minute had also been built, there was no precedent for a machine approximating 10,000 horsepower capacity running at a speed anywhere near as high as that proposed. The Westinghouse Electric & Manufacturing Co. of Pittsburg, Pa., however, undertook to build such a generator. The contract for the turbine was let on the proposal referred to, and the machine was built and installed, and is now in successful operation.

For the original installation a generating unit of this size would doubtless have been quite out of the question, because of the need for flexibility and reserve. In enlarging the station, however, the four existing units ensured ample flexibility as regards handling the output, irrespective of the size or number of new units. The advantages of the large capacity unit in economy of space and cost and in efficiency of operation did not, therefore, entail the disadvantages of excessive concentration of generating capacity.

The turbine is a horizontal shaft machine, and is of the highly popular Francis type, i. e., radial inward flow, with central axial discharge. The turbine proper has only one shaft bearing, which is located on the side away from the generator; the generator having two bearings makes the complete unit a three-bearing machine. This arrangement has proved to be eminently satisfactory, and is considered a feature of the general design. The discharge pipe or draft tube of the turbine is on the generator side (front side). The shaft bearing, thrust bearing and thrust balancing devices are located at the back side. The wheel is 66 inches outside diameter by 9½ inches wide through the vanes. It has 34 vanes, which extend a short distance inward beyond the end plate of the wheel on the discharge side, thus giving a slight "axial" effect and making the wheel a turbine of "mixed-flow" type rather than a pure radial-flow turbine. Suitable axial curvature is given to the tail of the vane to produce this axial reaction effect. The guide vanes, 32 in number, are of the swivel or Fink type. They are connected by means of arms projecting radially inward to a rotatable ring, concentric with the turbine shaft; this ring is actuated through connecting rod and shaft by a Lombard governor, whose regulator is driven from the generator coupling, as is clearly shown in the drawing.

The housing of the turbine is built of cast-iron segments, whose size was dictated by the fact that the turbine parts had to be lowered down the elevator shaft, the only means of access to the power chamber. The radial joint-face of the housing, which divides the spiral water case into halves, lies to one side of the vane passage. This disposition was adopted to secure greater lateral rigidity of the housing at its inner edge. In turbines with other types of regulating mechanism the fixed guide vanes tie the housing firmly together; with swiveling guide vanes, as in this turbine, such tying or stiffening effect is lacking, and at the same time greater stiffness than with fixed vanes is required in order that the vanes may swivel freely, without binding. For this reason a set of tie-diaphragms or spacers, which also act as preliminary guide vanes, is provided just outside of the swivel vanes. The arrangement of the radial joint one side of the axis of the turbine wheel results in keeping these spacers clear of all joints, making it possible to cast them integral with the sections forming the sides of the vane passage. In order to secure ample strength in these spacers without making them so thick or numerous as to interfere perceptibly with the free flow of water, a 2-inch rivet is driven in a hole drilled longitudinally through each, from outside to outside of housing.

The weight of the stationary parts of the turbine is carried directly by the housing; the latter rests on the foundation by three spread feet, two at the inlet and one at the governor end, cast integral, with the base section of housing. The weight of the moving parts, carried by the shaft, rests on the rear water wheel bearing and on the rear generator bearing. Where the shaft passes through the discharge casing it is packed by a stuffing box, which carries no vertical load. The rear water wheel bearing is a pedestal which foots on the foundation independently of the main housing; it is tied laterally to the housing by a floor plate at the foundation level. The bearing is a self-aligning spherical bearing 8⅜x26 inches, and has two oiling rings.

The turbine wheel or runner is an annular steel casting whose radial depth is only enough to contain the vanes. There is no hub or spider, but the shaft is enlarged into a disk of sufficient diameter (46 ins.) to permit of bolting the wheel ring directly to it. The vans of the runner are finished by filing smooth. The shaft is a nickel steel forging made by the Bethlehem Steel Co.; it is 13½ inches in diameter at the generator end, with a 30-inch coupling flange, and 8⅜ inches in diameter at the rear end; its total length is 15 feet 9 inches.

The means employed for balancing the thrust of the runner are of special interest. Single wheel horizontal shaft units are relatively infrequent in turbine practice especially in large sizes, where the thrust of a single runner is large enough to require careful consideration. The thrust is made of two parts: (1) that due to the static pressure or effective head of water at the various points of the runner surface; and (2) that due to the deflection of the water from a purely radial path through the wheel. As concerns the first part, the front face of the wheel is pressed upon by a pressure varying from the supply head at the outer circumference to the discharge pressure (vacuum) at the inner edge of the vanes, which latter extends over the whole central area of the runner (and shaft extension). The rear face of the

runner is subjected to the pressure of water leaking through the radial air-gap between casing and runner, substantially equal to the supply head. This greatly over-balances the pressure on the front face, and the resultant thrust is to the right (toward the draft tube). The discharge ends of the vanes, being curved transversely, also have a pressure component directed toward the right. The velocity effect produces a thrust directed toward the left, but this is very small and does not materially reduce the pressure thrust.

By far the larger part of the pressure thrust is eliminated by venting the space back of the runner into the discharge space. Six holes through the wheel near the shaft have this function. The water leaking in through the air-gap is continuously discharged through these vents into the draft tube, and the accumulation of any large static pressure back of the wheel is thereby avoided. There is a certain amount of centrifugal action, however, in this back space, due to the water being in part carried with the wheel, which results in producing a pressure toward the periphery, reducing the relieving action of the vents. To minimize this effect, the back head of the wheel case bears on its inner face a number of radial ribs projecting as close to the back face of the wheel as mechanical considerations permit; these ribs act to hold the water from rotating with the wheel and correspondingly reduce the centrifugal effect.

By these means the average pressure back of the runner is reduced to near atmospheric pressure, being slightly above atmosphere with full gate opening and slightly below atmosphere at low gate opening. The average pressure on the front of the runner, however, is always lower, and the resultant thrust is therefore toward the draft tube, though its amount varies considerably, being greatest for full gate opening. This thrust is taken up by the balancing piston immediately back of the rear head of the wheel case, and the ultimate balance and adjustment of position is accomplished by the collar thrust bearing behind the balancing piston.

The balancing piston is a forged enlargement of the shaft, finished to a diameter of 17 inches, which works in a brass sleeve set in a hub-like projection on the back of the wheel housing. The inside of the sleeve has six circumferential grooves each 1-inch wide and ¼-inch deep, as water packing. The chamber in front of the piston communicates by a pipe (containing a strainer) with the supply casing of the water wheel, and therefore receives the full pressure of the supply head. The chamber back of the piston is drained to the draft tube, so as to carry off any leakage past the piston. The device thus produces a constant thrust on the piston, directed toward the left. By throttling the pressure pipe this thrust can be adjusted as desired.

The thrust bearing consists of a group of four collars on the shaft, working in a babbitted thrust block which is bolted to the back of the wheel housing. The collars are formed on a steel sleeve which fits over the shaft and is bolted to the rear face of the balancing piston; this makes it possible, when the collars are worn out, to renew the bearing by dismounting the thrust block and placing a new sleeve. The thrust bearing is lubricated by oil immersion. An oil chamber is cored in the block, and communicates by numerous oil holes with the bearing faces; a constant flow of oil is maintained by means of oil supply and drain pipes. Concentric with the oil chamber and outside of it a water chamber is cored in the block. Cooling water is supplied to this chamber by a pipe from the pressure side of the turbine, and drains from the top of the bearing through a drain pipe to the draft tube. A U-pipe attached at one side of the bearing forms connection between the water chambers of the upper and lower halves of the block. This detail avoids making the connection by a hole through the joint face, which would allow leakage of water into the oil space and into the bearing.

The balancing piston is so proportioned and the pressure supply pipe is throttled to such a point as to give exact balance (i. e., with zero thrust in the thrust bearing) at about half to five-eighths the full output of the wheel. At larger power there will be an unbalanced thrust to the right, and at smaller output to the left, which are taken by the thrust bearing. The maximum thrust on the collars is about 25,000 pounds. The collars are 2½ inches high (2⅜ inches effective) by 13½ inches mean diameter, giving a total effective bearing area on four collars, of 418 square inches. The maximum collar pressure is thus about 60 pounds per square inch.

The regulation of the turbine is of the swivel gate type. The guide vanes are pivoted, and by means of an operating ring connected to all the guide vanes they are actuated by the governor, increasing or diminishing the width of the guide passages according to the change of load.

The guide vanes are integral with their pivots or spindles, being steel castings finished all over by turning and planing. The spindle is carried in the housing in tight-fitting brass sleeves, which serve as bearings and as packings. The forward end of the spindle does not extend through the casing, and to prevent any pressure existing behind it due to the unavoidable leakage of pressure water past the sleeve, which would produce a heavy end thrust on the spindle, a drain hole to the draft tube is provided. The rear end of the spindle projects through the casing and carries an arm engaging with the operating ring. The packing sleeve on this portion of the spindle is supplemented by a stuffing box back of it, and a separator in the packing of this stuffing box provides a drain space which is drained through a groove on the inner face of the end plate casting to the space back of the turbine runner.

The detail of the connection between the guide vane spindles and the operating ring is an interesting design. Each spindle has keyed to it an arm, outside of the turbine case, which is finished with a straight rectangular end. The end of the arm fits with a close sliding fit in a cylindrical block set in a cylindrical recess in the rear face of the operating ring, which gives a connection having ample bearing surfaces at all points of motion, thereby ensuring minimum wear at this vital point. Two blocks attached to the operating ring at diametrically opposite points project through slots in the cover ring and carry pins which serve as attachment for the operating rods from the governor sector. The length of the slots defines the maximum motion of the gate operating ring.

Accurate tests of the turbine have not been made. After it was installed, a test for efficiency was made, in which the output was measured on the electrical side, while the input was measured by the drop of head across the headgate, whose opening was accurately known. This test showed an efficiency, at 10,000 horsepower, of 84 per cent; this figure is subject, of course, to the inaccuracy of the method used for measuring the water consumption.

A test for maximum power was made by opening the swivel gates to their maximum opening, the governor being disconnected, as under this condition the gates could be opened slightly wider than the design called for. The test had in part the object of subjecting the machine to maximum strain. The highest capacity, registered by calibrated wattmeters, was 8,250 kilowatts, or 11,000 horsepower.

As soon as this part of the test was finished, Mr. Harrisburger, the general superintendent of the Seattle & Tacoma Power Co., was desirous to know how the power unit, both turbine and generator, would behave when let loose and run empty with wheel gates wide open and no load whatever on the generator. Previously being assured by the manufacturers of the turbine as well as of the generator that there was no objection to such test, it was decided to try it. The wheel was loaded up to its full capacity, the governor was disconnected, and then the switches were pulled, leaving the wheel as well as the generator without load and without control. The highest speed thus obtained was registered by the tachometer as 505 revolutions per minute. Mr. Harrisburger, to demonstrate his faith in machinery, was standing close to the water wheel while it was running at this speed.

News Notes.

WASHINGTON NEWS NOTES.

Spokane, Wash.—Frank T. Post, of Spokane, has bought the Spokane Smelting and Refining Company's smelter five miles west of Spokane, and it is given out it will be put into operation some time in October. The plant was erected sixteen years ago, but it has never produced bullion. Philadelphia and Grand Rapids, Mich., capital is said to be behind the deal.

The Anacortes mine in the Slate Creek district, northeast of Spokane, has been bonded to C. H. Freeman, a Colorado mining man, for $25,000, and it is understood he will put a mill on the property in the spring.

W. H. Mead, manager of the Mammoth Mining and Smelting Company's property in the Metaline country, east of Spokane, reports a strike of a ledge of galena, from 12 to 16 feet on the surface.

Eugene R. Day, manager of the Tamarack & Chesapeake mine in the Coeur d'Alene district, east of Spokane, says that stoping will begin in a few days and that the company will build a concentrator the coming spring.

Announcement is made that the Park Copper and Gold Mining Company, composed of Chicago, Spokane, Portland and Wallace, Ida., people, will begin work on its property near Mullan, Ida., in a few days. Cross-cutting will begin at once.

J. J. Browne, of Spokane, who has just returned from Skagway and Yukon mining territories, declares that gold mining there is yet in its infancy, and that the copper and coal outlook is promising.

Butte and Chicago capital, headed by Charles Mattison and Joseph Crossman, has bought control of the Hennessy-Burns mine near Burke, Ida., east of Spokane, and the property will be developed. It is a lead-silver proposition.

Deposits of iron ore, more than 35 feet wide, have been uncovered on the Gold King property on Belcher Mountain, north of Spokane. The ore carries about $17 in gold to the ton. The property is owned by the Bortel Copper Company.

The Picket Pin Mining Company has found $40 ore at a depth of 100 feet in the Black Hornet district in Idaho, south of Spokane. The strike was made 140 feet from the mouth of the tunnel.

Branch No. 3 of the Stoper of the World has been organized in Spokane with Col. N. E. Linsley, president, and E. L. Tate, secretary, and a membership of twenty.

The Idaho-Montana Mines Development Company has been incorporated in Idaho with a capital of $1,000,000. The head offices will be at Wallace, east of Spokane, and the company will develop a silver-lead group of claims just over the divide in Montana.

C. A. Hoag of Waterville, Wash., and a party of Chelan men have just secured a franchise for the construction of a telephone line from Chelan Falls to Lakeside, 25 miles west from Spokane. The line will also be built up the Columbia river and will have long distance connection with the Pacific States line.

Wenatchee, west of Spokane, has a lively telephone war, and as a result the Pacific States Telephone & Telegraph Company is making contracts to furnish instruments to subscribers outside the city at $1 a year. Prior to the organization of the Farmers' Telephone Company the charge was $2.50 a month, which was afterward cut to $1.50 and then to $1 a year.

FINANCIAL.

San Francisco, Cal.—Advices from New York state that the directors of the Western Union Telegraph Co. have authorized President Clowry to call a meeting of stockholders on October 10th to vote on a proposition to issue $25,000,000 in gold bonds. The directors also voted that $10,000,000 in gold bonds be issued immediately for subscription by stockholders. The money realized from the bonds is to be used for new construction and the purchase of new property.

San Francisco, Cal.—F. A. Pickernall, assistant to President Fish of the American Telephone & Telegraph Co. of Boston, the Bell system, has stated that a complete organization of the Pacific States Telephone & Telegraph Co. would take place in the near future. Mr. Fish will direct the affairs of the Pacific States Telephone & Telegraph Co. from Boston, just as Harriman directs the Southern Pacific from New York. The Bell company will spend $10,000,000 during the next year in improving its telephone and telegraph system on the Pacific Coast. San Francisco will receive the largest share of this appropriation of the Bell company, which will be about $3,000,000.

Oakland, Cal.—Beginning September 13th, the conductors and motormen of the Oakland Traction Consolidated and the conductors, motormen and gatemen of the San Francisco, Oakland & San Jose Railway, known as the Key Route, were given a voluntary increase of 3 cents an hour, and they are now receiving the highest wages paid to platform men in the United States. It is estimated that the raise in wages of the carmen means a joint increase of $8,500 a month on the payroll of the Oakland Traction and the Key Route.

INCORPORATIONS.

Martinez, Cal.—The Great Western Power Co. of Point Richmond has filed its articles of incorporation. The amount of capital stock is $25,000,000, divided into 250,000 shares. W. S. Rheem, one of the directors of the East Shore & Suburban Railroad Co., is a leading factor in the enterprise, while associated with him are Guy C. Earl of Oakland, H. G. Young, E. A. Gowe, W. Stairley and L. D. Dimm of Richmond, F. D. Madison of San Rafael and B. C. Carroll of Oakland.

Los Angeles, Cal.—The Hines Land & Water Co. has been incorporated. The capital stock of the company is $10,000, subscribed by C. H. Lillibridge, A. L. Parmly, Miles Swift, W. G. Young and J. W. Young.

San Francisco, Cal.—The Central California Power Co. has been incorporated. The capital stock of the company is $5,000,000. The directors are Geo. A. Clough, Baldwin Wood, Oscar Cooper, Chas. A. Rose and Chas. A. Bray.

San Francisco, Cal.—The Shasta Power Co. has been incorporated. The capital stock of the company is $1,000,000. The directors of the company are H. L. Shannon, F. Kingsbury, T. I. O'Brien, Chas. Jacobson and John W. Potts.

Bellingham, Wash.—The Alaska Drilling and Mining Company has been organized by Charles I. Roth, Samuel Altshuler, Jaems D. Espey and A. H. Miller, with capital of $100,000, to develop placer bed on Ophir Creek near Nome.

TELEPHONE AND TELEGRAPH.

Anacortes, Wash.—The Farmers' Mutual Tel. Co. was granted permission to set poles on Q avenue.

Granite Falls, Wash.—The Sunset Tel. Co. was granted a franchise to run its lines on Stanley street from the town limits to Granite avenue and from there to Pioneer street.

Portland, Ore.—Foundations for three exchanges for the Pacific States Tel. Co. have been laid at North Albina, Mt. Tabor and on Holgate street near Milwaukie road; buildings will cost $15,000 each.

Weiser, Idaho.—John Weltzheimer and Arthur Dodd left with a crew and outfit for Biggerstaff's Siding, where they will construct the Pin telegraph line to the stage station at Price Valley, a distance of six miles.

Ashland, Ore.—A telephone line to the Dead Indian country, 25 miles, and to Buck Lake, 40 miles, will be built at once, to be connected with the Ashland exchange of the Sunset Co.

Chehalis, Wash.—The Home Telephone Co. have applied to the county commissioners for a franchise to use all the county roads in extending its system.

Dillon, Mont.—The Southern Montana Telephone Co. voted to make numerous extensions in the Big Hole basin.

Helena, Mont.—The Lewiston-Billings Telephone Co. has filed notice of increase of capital stock from $20,000 to $50,000.

Oregon City, Ore.—County court granted a franchise to the Northwest Long Distance Telephone Co. of Portland to erect and maintain a telephone service throughout the county.

Red Lodge, Mont.—The Montana & Wyoming Telephone Co. is building an interurban line to Clear Creek, a distance of 15 miles.

Spokane, Wash.—The Interstate Telephone Co. has called a stockholders' meeting for November 2, when the capital stock will be increased from $100,000 to $500,000. The company plans to extend its lines outside of Spokane and intends to put in an exchange in this city.

San Francisco, Cal.—In the restoration of its system, the Pacific States Telephone & Telegraph Co. is doing considerable underground construction work, which will be extended to the "South" and residential districts and to the newly-created business sections of the city. The cost of installation of the underground system is far in excess of that for the old system, but the expense for the maintenance is greatly reduced. The underground system will last for a period of 25 to 50 years and its durability is therefore in its favor.

Berkeley, Cal.—The new Gamewell police alarm system has been installed. The policemen will be saved the time which they formerly spent in reporting to the office. A large part of the work will be done automatically. Box keys in the hands of citizens will enable the turning in of alarms and calls without the trouble of hunting an officer. The boxes on the corners will contain telephones to headquarters.

Tiburon, Cal.—The Sunset Telephone Co.'s central office was destroyed by the big fire of last week.

Redding, Cal.—A new telephone system is to be put in here. Under the new system no bells will ring except when subscribers are called. A couple of months will complete the work.

Reno, Nev.—A trans-mountain branch of the Postal Telegraph & Cable Co. will be constructed soon, with a main office at Reno. Wires will be strung from Salt Lake to San Francisco, with subsidiary lines to Tonopah and the southern mining country.

Carson City, Nev.—The Southern Nevada Consolidated Telephone & Telegraph Co. has been granted a franchise to operate its lines in the state.

TRANSMISSION.

Ogden, Utah.—Officials of the Bamberger electric line are considering a site near Farmington upon which to erect a steam power plant.

Marysville, Cal.—The Bay Counties Power Co. has made a survey for a new power transmission line that will pass through this city on Eighth street and across the west levee at Ninth and K streets, thence following Ninth street through the river bottoms to Feather river, where towers will be built on each side to cross the stream. This line is to supply the Northern Electric Railway with power through the sub-station now being built on the Stocking tract near Yuba City.

Gridley, Cal.—The men employed by the Bay Counties Power Company, who have been engaged in erecting a new pole line on which to string wires for carrying the "juice" to the sub-station of the Northern Electric Road, have finished their work in this vicinity and will now take up the section near Biggs. The sub-station which is under construction a mile and a half east of town is being fitted with the heaviest of concrete foundations for the heavy machinery.

Nevada City, Cal.—Seventy men have been laid off and all work ordered suspended until spring at the new power house on Deer creek, east of this place. Work on the structure was being rushed, the announcement being made recently that the Bay Counties Company intended to finish it before winter set in. The remainder of the machinery which has arrived here will be hauled to Deer creek and stored for winter.

Salt Lake, Utah.—H. S. Campbell, of the Utah Light & Railway Company, has been awarded the contract for his company to furnish power for running all street cars owned by the Ogden Rapid Transit Company.

Monterey, Mexico.—With a view to furnishing power to mines in the Etzatlan district, Apolinio Garcia of Guadalajara has made arrangements to increase the capacity of the hydro-electric plant on the Petrero hacienda near Tequilla. The present capacity of the plant is 200 horsepower.

POWER AND LIGHT PLANTS.

Baker City, Ore.—John Thomsen, manager of the Tremont Power Co. and the Rey Boy mine, states that the plant of the property will be changed from steam to electrical power.

Boise, Idaho.—Carroll George Dollman of Hagerman reports that plans are being made to erect a power plant at Salmon Falls.

Dawson, Yukon Territory.—The Dawson Electric Light & Power Co., recently sold under foreclosure of mortgage, has been taken over by N. A. Fuller, a Tanana and Dawson capitalist, and Dr. A. S. Grant, who are preparing to furnish all the power in the future by 50 miles of trunk line from the Coal Creek coal mines, where the fuel will generate electricity.

Edmonton, Alta.—It is reported that discoveries of crude oil and natural gas in immense quantities have been made in the Athabaska river region, 300 miles north of this place.

Kennewick, Wash.—The machinery is being installed for the waterworks and electric lights. The reservoir is completed and most of the pipe laid.

Snohomish, Wash.—The Snohomish Light & Power Co. is pushing work on its sub-station, corner of First and Maple. The station will be a temporary affair for the next few weeks only, when a fine brick building will be put up.

South Bend, Wash.—M. C. Welsh of the South Bend-Raymond Electric Co. states his company will have their plant running in 90 days. They will supply Raymond and this place with lights.

TRANSPORTATION.

Palo Alto, Cal.—The board of trustees of the Stanford University have been requested to decide upon one of several routes through the campus, all of which have been surveyed, for the railroad which the Peninsular Electric Railway Co. is constructing in Palo Alto. The electric company, which desires to pass through the estate, has secured a right of way from Los Gatos to San Carlos and proposes to skirt the foothills, touching all of the principal towns of Santa Clara and San Mateo counties.

Los Angeles, Cal.—An ordinance has been presented to the city council asking that the Los Angeles-Pacific Co. be granted the right to construct tracks, and for a period of 21 years to maintain the same and operate a double-track railroad through the tunnel to be constructed on Hill street between First and Temple streets. The ordinance also asks a similar privilege for tracks under California street and lands belonging to the city between California street and Sunset boulevard, and to connect with the Los Angeles-Pacific tracks now on Sunset boulevard.

San Francisco, Cal.—Three hundred and twelve new cars, costing in the aggregate more than a million dollars, have been ordered by the United Railroads. Fifty cars have been ordered from Chicago, of which 25 are now running in this city. Twelve special cars have been ordered from the Philadelphia and Western Car Works for the suburban service.

San Francisco, Cal.—At present there are 1,000 men working on track construction for the United Railroads. The heaviest steel rails are being laid.

Palo Alto, Cal.—The Hanchett Electric Motor Co. has begun work tearing up the streets preparatory to laying the track for the new rapid transit system.

San Francisco, Cal.—A circuit-breaker at the junction of Market and Third streets kept the power off from the trolley wires on Market street that cross Third for a quarter of an hour September 17th. Cars were lined up on Market as far as the eye could reach. There was plenty of power on Market, but the cars were unable to cross the intersection of the streets at Kearny and Third.

El Paso, Texas.—Application has been made to the city council by Frank Tobin and others for a franchise for four new street car systems to cover 15 miles of street and extend into the valley to Ysleto.

Gardnerville, Nev.—The Truckee River General Electric Co. will begin at once the extension of its lines to Gardnerville.

San Bernardino, Cal.—I. C. A. Denman, Jr., has applied for a franchise for an electric road for 49 years on and over certain streets in this city. Notice has been given that sealed proposals will be received for the franchise up to October 15th. Harry Allison, city clerk.

Redding, Cal.—Redding, Keswick station, Coram, Kennet, Delmar and Afterthought camp are to be connected by an electric road soon. R. D. Radcliffe, the father of the project, has left for the East with full details and figures on the proposed line.

Redlands, Cal.—A. C. Denman, president of the traction company, has appeared before the San Bernardino council and filed application for franchise for double tracking the company's system in that city. Franchise will give right to double track to northern part of the city.

Los Angeles, Cal.—The residents of La Canyada have asked H. E. Huntington to build an electric road to their valley from a connection with the Eagle Rock line through Verdugo canyon. It is said that if the matter of right of way can be settled satisfactorily the building of the road is assured.

ILLUMINATION.

Porterville, Cal.—B. M. Maddox, manager of the Mt. Whitney Power Co., has been here accompanied by J. C. Hays of Visalia and son, J. C. Hays, Jr., of New York, a civil engineer, who is out here to inspect and make a report on the company's plant for John Hays Hammond. The Globe Light & Power Co., in which the Mt. Whitney Co. is interested, has received its permit from Washington to build its power plant on Tule river and take the water out of the junction at the Forks and flume it down eight miles to where the plant will be located.

Ogden, Utah.—The city council has granted to George A. Snow and others the right to manufacture gas and to construct, operate and maintain gas mains, pipes, for supplying Ogden.

Los Angeles, Cal.—Capt. Charles Hartley, a civil engineer, has made public a plan whereby the city might utilize the power that could be derived from the fall of the sewer water for the purpose of running the municipal lighting plant. It is stated that one company has offered to install the necessary plant to generate electrical power by using the waste water for $45,000.

Grass Valley, Cal.—The city is contemplating the advisability of installing a municipal lighting system at a cost of $80,000.

City of Mexico.—J. H. Buchanan of Mexico City has been visiting a number of mining camps in the vicinity of Oaxaca with the object of investigating the possibilities of establishing gas power producing plants.

San Francisco, Cal.—It is stated that the San Francisco Coke & Gas Co. has had its architects and engineers busy for two months planning a new plant, which will be the medium through which the company will receive and distribute the electric power of the Stanislaus Power & Irrigation Co., with which the local company has entered into a contract.

Lodi, Cal.—J. Jerome Smith of Stockton and H. C. Keyes of Sacramento, president and secretary respectively of the Lodi Natural Gas Co., have been in Lodi inspecting a site for the purpose of locating a plant. Mr. Keyes stated that it was the intention of the company to manufacture artificial gas.

WATERWORKS.

Salt Lake, Utah.—L. C. Kelsey is making arrangements for the installation of a pumping plant at the pumping station.

Modesto, Cal.—It has been decided to purchase a large pump and engine and install a pumping station at this place.

Fullerton, Cal.—E. H. Stone will erect a pumping plant on the ranch next to the one recently sold in La Habra.

Merced, Cal.—City Attorney Henderson has proposed that a town pump be established at the intersection of Main and Canal streets.

Dawson, Alaska.—L. S. Robe and Wilson & Stackpool have applied to the government of Yukon for a grant of 60,000 inches of water to be taken from the Twelve Mile river, a mile from Yukon river, to be used for generating electricity to furnish power for Yukon and Alaska mining camps. The applicants guarantee in consideration of the grant being issued to spend $200,000 on the work this year and to have the plant in operation two years from the day the grant is issued.

Alturas, Cal.—The trustees are making an effort to obtain a water supply. They recently purchased an acre of land on the summit of Gleason hill, upon which construction of a reservoir is contemplated. A deep well will probably be sunk upon the reservoir site and a motor put in place for pumping.

OIL.

San Francisco, Cal.—It is reported that the Standard Oil Co. has been acquiring certain lands and plants owned by California persons who have invested considerable wealth in gas and electric enterprises throughout the state, and especially in this city. The report reached Wall street that a third company was about to enter the local field in competition with the San Francisco Gas & Electric Co. and the San Francisco Gas & Coke Co. The news was that the Standard Oil Co. was backing the new venture and this resulted in considerable flurry among stockholders of both of the local concerns, although no visible effect was shown in stock quotations.

Fresno, Cal.—The report is that a great flow of oil has been struck by the Lucile Oil Co. in the Coalinga fields. The daily flow is estimated at 800 barrels.

Lewiston & Southeastern Electric Railway Company.—Stockholders have authorized the directors to issue first mortgage 5 per cent gold bonds to the amount of $3,000,000 on that corporation and $2,000,000 on the Central Idaho Development Company, dated August 1, 1906, and payable August 1, 1936. The Scofield Company of Philadelphia has the contract to build 100 miles of line between Lewiston and Grangeville, Idaho. Work will begin the coming fall.

Spokane, Cheney & Southern Electric Railroad.—Charles P. Lund, executive officer of the company, announces that construction work will begin early in September on the line between Spokane and Cheney, Wash., 19 miles. The company will use the Washington Water Power Company's lines between Spokane and Hayford, nine miles. The route from Hayford to Cheney is over low grades and has only a few curves. Detroit type motor cars will be used on the line.

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